Attachment B–3

HUDSON RIVER BIOLOGICAL MONITORING PROGRAM
STRIPED BASS AND ATLANTIC TOMOCOD SURVEYS
STANDARD OPERATING PROCEDURES

NORMANDEAU ASSOCIATES, INC.
Bedford, New Hampshire

November 2011

2011-2012 HUDSON RIVER STRIPED BASS AND ATLANTIC TOMCOD PROGRAMS STANDARD OPERATING PROCEDURES

November 2011

Prepared for

INDIAN POINT ENERGY CENTER

450 Broadway, Suite 1

Buchanan, NY 10511

Prepared by

NORMANDEAU ASSOCIATES, INC.

25 Nashua Road

Bedford, NH 03110

#22800.099

Hudson River Striped Bass and Atlantic Tomcod Programs Standard Operating Procedures

Distribution List	Copies
D. Gray (Entergy)	1
K. Dowell (Entergy)	2
M. Daley (Dynegy)	3
J. Carter (NOS)	4
K. Damon-Randall (NOAA)	5
C. Nieder (NYDEC)	6
L. Wilson (NYDEC)	7
J. Young (Applied Science Associates)	8
M. Mattson (Normandeau)	9
P. Lindsay (Normandeau)	10
J. Melgey (Normandeau)	11
M. Ricci (Normandeau Field)	12
C. Sweeney (Normandeau Field)	13
C. Burnett (Normandeau Field)	14
W. Furman (Normandeau Field)	15
A. Spadavecchia (Normandeau Field)	16
J. Blan (Normandeau Laboratory)	17
H. Proctor (Normandeau Laboratory)	18
R. Hasevlat (Normandeau QA)	19
J. Childs (Normandeau Data Center)	20
L. Cable (Normandeau Publications Dept.)	Original

I have read and understand this document.

_____ Signature

_____ Date

TABLE OF CONTENTS

SECTION I. INTRODUCTION

The 2011-2012 Hudson River Striped Bass Program is designed to catch, tag, release and recapture age 1+ and age 2+ striped bass for the purpose of estimating the size of the mid-winter population. Because no marked hatchery fish were stocked since 1995, and no hatchery fish have been recaptured since 1998-99, striped bass caught during the 2011-2012 program will no longer be checked for the presence of magnetic coded wire tags that were implanted in all hatchery fish.

Atlantic tomcod is one of the species whose population has been monitored as part of the Atlantic Tomcod Program. Accurate estimates of abundance, which are only available since the 1982-1983 sampling season, indicate that the population size of Hudson River Atlantic tomcod has varied widely between 0.09 and 12.5 million fish. Data from the 1985-1986 through present Atlantic tomcod programs indicate that accurate estimates of Atlantic tomcod abundance are obtained by tagging and releasing Atlantic tomcod captured in box traps in the middle estuary during December through February and examining the catch of Atlantic tomcod in trawl samples taken in the lower river during February through April. Prior to 1998-1999 Atlantic tomcod captured and released from the box traps were marked with finclips. Beginning in the 1998-1999 program, Atlantic tomcod released from the box traps were marked with a visual implant tag rather than finclips to provide information on the distribution, movement rates and growth of individual fish**.** Visual implant tags will be used to mark Atlantic tomcod during the 2011-2012 program although finclips may be used to mark large batches of fish if the field crew leader determines that doing so would substantially minimize tagging mortality.

The objectives of the 2011-2012 Striped Bass/Atlantic Tomcod Program are to:

A. Striped Bass Program
   1. describe the catch characteristics of the 9-m trawl used to capture striped bass in the lower Hudson River during the winter,
   2. describe the length- and age-distribution of striped bass in the lower Hudson River during the winter,
   3. estimate the abundance of age 1+ and age 2+ striped bass overwintering in the lower Hudson River,
   4. maintain a collection of striped bass scales, and
   5. compare the results obtained in A1-A3 with those reported from previous years.

B. Atlantic Tomcod Program
   1. estimate the abundance, sex ratio and age structure of Atlantic tomcod in the Hudson River,
   2. describe the biocharacteristics of Atlantic tomcod in the Hudson River,
   3. compare the results obtained in B1-B2 with those reported from previous years.

The objectives of the Striped Bass Program will be accomplished by trawling for 24 consecutive weeks in the lower Hudson River, including upper New York Harbor, from the week beginning Monday, 31 October 2011 through the week ending Friday, 20 April 2012.

The objectives of the Atlantic Tomcod Program will be accomplished by developing a population estimate for 2011-2012 using upriver box traps as the marking gear and downriver trawls as the

recapture gear. The box trap program will be conducted for 13 consecutive weeks from Monday, 5 December 2011 through Friday, 2 March 2012. During the 1998-1999 program we ceased marking Atlantic tomcod with finclips and began using visual implant tags inserted in the right operculum to help provide information on the distribution, movement rates and growth of individual fish. During the 2011-2012 program all Atlantic tomcod will be marked with visual implant tags, although finclips may be used to mark large batches of fish if the field crew leader determines that doing so would substantially minimize tagging mortality.

Normandeau will process all Atlantic and shortnose sturgeon in accordance with the terms and conditions of the Permit To Take Protected Species For Scientific Purposes Permit No. 1580-01 (Appendix 4).

Normandeau will determine the identity and length distribution of all remaining fish in the trawl sample after the sturgeon, striped bass and Atlantic tomcod have been processed. Fish will be sorted into length groups in accordance with division length limits set in the weekly Normandeau Associates Division Cutoffs list for 2011-2012 and returned to the river alive.

Collecting permits for the 2011-2012 striped bass and Atlantic tomcod Programs issued by the states of New York and New Jersey are shown in Figure I-1.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
License to Collect or Possess: Scientific # 1382

LICENSE
Under the Environmental Conservation Law (ECL)

Licensee Information

License Issued To:
MICHAEL J RICCI
NORMANDEAU ASSOCIATES INC
25 NASHUA RD
BEDFORD, NH 03110

(603) 472-5191

DEC Contact Information

DIVISION OF FISH, WILDLIFE AND MARINE RESOURCES
SPECIAL LICENSES UNIT
625 BROADWAY, ALBANY, NEW YORK 12233-4752
PHONE: (518) 402-8985 FAX: (518) 402-8925
WEBSITE: www.dec.state.ny.us

License Authorizations

License to Collect or Possess: Scientific
License # 1382

New License Effective Date: 12/1/2010 Expiration Date: 11/30/2011

NYSDEC Approval

By acceptance of this license, the licensee agrees that the license is contingent upon strict compliance with the ECL, all applicable regulations, and all conditions included as part of this license.

License Regulations

6 NYCRR Part 175
ECL 11-0515 (1)

Issued License **Page 1 of 5**

Figure I-1. Collecting permits for the 2010-2011 Hudson River Striped Bass and Atlantic Tomcod Programs

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
License to Collect or Possess: Scientific # 1382

LICENSE TO COLLECT OR POSSESS: SCIENTIFIC - LICENSE CONDITIONS

1. Collection from the Wild: Authorized Species, Specific The licensee is authorized to collect and possess the following species: Atlantic tomcod Microgadus tomcod, Striped bass (Morone saxatilis)

2. Scientific Collection - Location The licensee is authorized to collect species from the following locations only:
Hudson River south of river mile 76, including the East and Harlem Rivers.

3. Scientific Collection - Authorized Activities The licensee is authorized to possess the collected species for the following activity(ies): New York Power Authority Striped Bass Evaluation/Atlantic Tomcod Program

4. Scientific Collection – Fish Voucher Specimen When making collections authorized herein, the licensee and/or designated agents shall release alive all species which are not a necessary part of the proposed study.

5. Scientific Collection – Gear Marking and Monitoring The licensee shall mark all gear deployed with the licensee's name, resident address and license type and number. All traps and nets shall be checked no less than once every twenty-four (24) hours.

6. Scientific Collection - Authorized Fish Collection Equipment The licensee shall only collect fish using
Collection methods for Atlantic tomcod: 9 meter otter trawl and box traps. Striped bass: 9 meter otter trawl. Vessel: 37 foot research vessel (fiberglass hull) "R/V Pannaway."

7. Scientific Collection - LCP - No Endangered or Threatened Species No endangered/threatened species may be collected or possessed pursuant to this license.

8. Scientific Collection - Incidental Collection of Endangered or Threatened Species - Mandatory Release The licensee shall, if any endangered or threatened species are incidentally collected, immediately release such species unharmed at the original point of capture.

9. Scientific Collection - Incidental Mortality of Endangered or Threatened Species - Marine Species The licensee shall, if any endangered or threatened species are incidentally killed, contact the Bureau of Marine Resources Finfish and Crustaceans Section at the number below and make arrangements for delivery of the specimen(s) to them.
NYS DEC
205 Belle Meade Road, Suite 1
East Setauket, NY 11733
(631) 444-0435.

10. Scientific Collection - Atlantic Sturgeon No Atlantic sturgeon (Acipenser oxyrhynchus) may be collected or possessed pursuant to this license. Any sturgeon incidentally collected shall be measured for total length, the Regional Hudson River Fisheries Unit contacted to obtain PIT and carlin tags, then released alive; dead specimens shall be deposited with the NYS DEC Regional Fisheries Manager.

11. Scientific Collection - Conservation Officer Notification Marine and Coastal District The

Issued License **Page 2 of 5**

Figure I-1. (Page 2 of 7)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
License to Collect or Possess: Scientific # 1382

licensee shall notify the appropriate Regional Environmental Conservation Officer prior to all collection activities. The name, registration number and a description of the vessel must be provided in the notification. Regional Law Enforcement telephone numbers are: Long Island, Region 1: (631) 444-0250 (Nassau and Suffolk counties) and New York City, Region 2: (718) 485-4885.

12. Scientific Collection - Federal and Local Licensing Requirements The licensee shall determine if a corresponding Federal or local Permit is required to exercise the authority granted in this license. If a corresponding Federal or local Permit is required, the licensee shall obtain a valid Federal or local Permit before conducting any activity pursuant to this license.

13. Scientific Collection - Authority to Designate Agents The licensee is authorized to designate agents to assist the licensee with the listed animals while conducting activities authorized pursuant to this license provided that:

a. the licensee submits a written request to the NYSDEC Special Licenses Unit at the address listed on the front of this license containing the:
- i) name
- ii) address
- iii) age
- iv) phone number of the person he or she is nominating as a designated agent, and;

b. the licensee receives an amended license from the Special Licenses Unit listing the designated agents he or she has nominated before that person can conduct activities authorized by this license.

14. Authorized Designated Agents The following Designated Agents are authorized: On file with Special Licenses

15. Scientific Collection - Reporting Requirement - Prior to Expiration The licensee shall file a written annual report prior to the expiration date of this license. Such annual report shall contain: a) name of the licensee, b) license number, c) common name of the listed animals collected, d) location(s) of collection, e) date(s) of collection, f) biological data collected and g) final disposition of collected animals. The licensee shall send this report to the NYSDEC Special Licenses Unit 625 Broadway, Albany, NY 12233-4752.

16. Scientific Collection - Reporting Requirement - Marine and Coastal District The licensee shall file a written annual report prior to the expiration date listed on this license with the:
Chief of Finsfish and Crustaceans
NYS DEC
205 Belle Meade Road, Suite 1
East Setauket, NY 117733

GENERAL CONDITIONS - Apply to ALL Authorized Licenses

1. GC – Licensee Shall Read All Conditions The licensee shall read all license conditions prior to conducting any activities authorized pursuant to this license.

2. GC – Reasons for Revocation This license may be revoked for any of the following reasons:

i. licensee provided materially false or inaccurate statements in his or her application, supporting documentation or on required reports;

Issued License **Page 3 of 5**

Figure I-1. (Page 3 of 7)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
License to Collect or Possess: Scientific # 1382

ii. failure by the licensee to comply with any terms or conditions of this license;
iii. licensee exceeds the scope of the purpose or activities described in his or her application for this license;
iv. licensee fails to comply with any provisions of the NYS Environmental Conservation Law, any other State or Federal laws or regulations of the department directly related to the licensed activity;
v. licensee submits a check, money order or voucher for this license or application for this license that is subsequently returned to the department for insufficient funds or nonpayment after the license has been issued.

3. GC – Licensee Shall Carry Copy of License The licensee shall carry a copy of this license or a document provided by the department, if relevant, when conducting activities pursuant to this license.

4. GC – Licensee Shall Notify of Change of Address The licensee shall notify the Special Licenses Unit in writing, by mail or email, within five (5) days of the official change of residence.

5. GC – License is Not Transferrable This license is not transferrable and is valid only for the person identified as the licensee.

6. GC – Licensee is Liable for Designated Agents If designated agents are authorized pursuant to this license, the licensee shall be liable and responsible for any activities conducted by designated agents pursuant to this license or any actions by designated agents resulting from activities authorized by this license.

7. GC – Licensee Renewal The licensee shall submit a written request for the renewal of this license prior to the expiration date listed on the license. The licensee shall include accurate and complete copies of any required reports with their renewal request. This renewal paperwork shall be sent to:

NYSDEC
Special Licenses Unit
625 Broadway
Albany, NY 12233-4752.

This license is deemed expired on the date of expiration listed on the license.

NOTIFICATION OF OTHER LICENSEE OBLIGATIONS

MN– Licensee is Liable
The licensee shall be liable and responsible for any activities conducted under the authority of this license or any actions resulting from activities authorized by the license.

MN – Access by Law Enforcement
The licensee shall allow representatives of the NYS DEC Division of Law Enforcement to enter the licensed premises to inspect his or her operations and records for compliance with license conditions.

Trespassing Prohibited
This license is not a license to trespass. The licensee shall obtain permission from the appropriate landowner/land manager prior to conducting activities authorized pursuant to this license

Issued License **Page 4 of 5**

Figure I-1. (Page 4 of 7)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
License to Collect or Possess: Scientific # 1382

Issued License Page 5 of 5

Figure I-1. (Page 5 of 7)

Date Issued: 12/08/10
Number: **1102**

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

S CHRISTIE
vernor

GUADAGNO
Governor

BOB MAR
Commissi

Mail Code 501-03
Division of Fish and Wildlife
P.O. Box 420
Trenton, NJ 08625-0420
David Chanda, Director
www.NJFishandWildlife.com
(609) 292-2965

01/01/11 to 12/31/11

SCIENTIFIC COLLECTING PERMIT

TO WHOM IT MAY CONCERN:
Under provisions of New Jersey Statutes Annotated Title 23:4-52, permission is hereby given to:

Michael J. Ricci for Normandeau Associates, Inc., 25 Nashua Road, Bedford, NH 03110 to conduct the 2010-2011 Hudson River Striped Bass Stock Assessment/Atlantic Tomcod Program. Any dead striped bass will be returned to the lab for stomach analysis and Atlantic tomcod will be returned for biocharacteristics. Gear will be a 3'x3'x6' box trap for collection of Atlantic tomcod; 9 meter trawl and 16 foot trawl for collection of striped bass and tomcod. Collections will take place in the New Jersey portion of the upper and lower New York Harbor, Hudson River, Hackensack River, Passaic River, Newark Bay, Kill Van Kull and Arthur Kill. Vessel to be use will be the 37' research vessel Pannaway (white fiberglass hull) Reg. No. 589424 and the 25 foot (white fiberglass hull) Privateer Reg. No. NH0572 BF.

This permit is subject, but not limited to, the following conditions:

1. The person(s) named herein shall have this permit in their possession when collecting scientific specimens in marine, fresh, or estuarine waters of the State and must present it upon request to any official or citizen.

2. The holder of this permit shall notify the Marine Enforcement Office of his/her scientific collecting activities in any of the State's marine, fresh, or estuarine waters at least 24 hours in advance of their activities. Notification can be made in writing to the Marine Enforcement Office, P.O. Box 418, Port Republic, NJ 08241, or by calling 609-748-2050.

3. A report of the organisms collected (species, numbers, specific location where taken, dates of sampling) or a final report for the study for which the permit is requested shall be sent to Mail Code 501-03, Administrator, Marine Fisheries,

Figure I-1. (Page 6 of 7)

P.O. Box 420, Trenton, NJ 08625-0420, within four (4) weeks of the expiration date or upon request for permit renewal, whichever is earlier.

4. The provisions of this permit may not apply to any of the species listed by the United States Government as endangered. Special provisions may apply for certain of these endangered species.

5. This permit does not convey the right to trespass.

6. Violation of any condition of the permit or any state law or regulation promulgated pursuant to N.J.S.A. 23 or 50 or N.J.A.C. 7:25 or 7:25A shall render this permit null and void and subject these persons to prosecution in addition to permit revocation upon conviction. Applications for future permits may also be denied.

7. The holder of this Scientific Collecting Permit is also required to have in his/her possession a "Special Permit for Research" from the Division of Science & Research, Bureau of Marine Water Monitoring, P.O. Box 029, Trenton, NJ 08625, prior to the taking of shellfish for scientific purposes from the marine or estuarine waters of the State that are designated "Prohibited," "Special Restricted," or "Seasonal Special Restricted" (N.J.S.A. 58:24-3, and N.J.A.C. 7:12-2). A chart of these designated waters may be obtained from the Bureau of Marine Water Monitoring or by visiting www.nj.gov/dep/wms/bmw.

Thomas W. McCloy, Administrator
Marine Fisheries Administration

bd
c: Marine Enforcement Unit
Timothy Cussen, Chief, Bureau of Law Enforcement
Lt. Chris Simmermon, NJ State Police
Debbie Watkins, Bureau of Marine Water Monitoring

Subsidiary Student or Employee Permit Holder

Mark Mattson	Michael Ricci
Peter Stevens	B. Paul Lindsay
Charles Sweeney	Scott Schanke
Christopher Burnett	William Furman
Mike Mettler	Craig Tompkins
Lawson Upchurch	Chuck Porembski
Joan Blan	Anthony Spadavecchia
Chris Ward	Erik Fel'Dotto
Andrew Saltalamachia	Chris Ward
Ben Carson	

Figure I-1. (Page 7 of 7)

SECTION II. STRIPED BASS/ATLANTIC TOMCOD TRAWLING

1.0 GEAR DEPLOYMENT

A 9 m trawl will be used (Table II-1). **Note: The 9 m trawl used prior to the 2010-2011 survey was worn and a new net was built prior to the start of the 2010-2011 survey. However, the 3 mm twine diameter, 3.8 cm stretch mesh netting used to form the body of the cod end of the 9 m trawl was no longer manufactured, requiring mesh of the cod end to be made with 2.2 mm diameter (0.086 inch) green polyethylene twisted twine.**

Table II-1. Specifications of the 9 m Trawl used for striped bass trawling during the 2011-2012 program.

GEAR CODE = 49

Head rope length	6.9 m (23 ft)
Foot rope length (Sweep)	9.0 m (30 ft)
Legs	6.0 m (20 ft)
Net body length	5.2 m (17 ft)
Net body mesh	7.0 cm (2.75 inch) stretch mesh of 2 mm diameter (0.078 inch) green polyethylene twisted twine
Cod end section length	2.3 m (7.5 ft)
Cod end section mesh	3.8 (1.5 inch) stretch mesh of 2.2 mm diameter (0.086 inch) green polyethylene twisted twine
Doors (steel V-doors)	1.0 m (3 ft)
Roller Gear	25.4 cm (10 inch) rollers spaced with 5 cm (2 inch) cookie disks

1.1.1 A 9 m trawl (Table II-1) will be deployed in the Hudson River for 24 consecutive weeks from the week beginning Monday, 31 October 2011 through the week ending Friday, 20 April 2012. A non-void sample is defined as having a USE_CODE of 1 (see Section II-1.1.9). All striped bass caught will be measured to the nearest millimeter total length (mm TL), and examined for streamer tags or tag wounds. All striped bass ≥150 mm TL will be tagged and released from trawl samples. Atlantic tomcod will be measured to the nearest mm (TL) and examined for visual implant tags or finclips. Atlantic tomcod will not be tagged when caught and released from the trawl effort south of the George Washington Bridge (Hudson River Mile 11), except in years when catch rates are low and only when directed by Project Management following review of weekly catch summaries.

1.1.2 Upper New York Harbor from the Battery (River Mile 0) to Liberty Island (Harbor Mile 4) will be coded as STATION=4. The Hudson River from the Battery to the George Washington Bridge (River Mile 11) will be coded as STATION=11. The Hudson River from north of the George Washington Bridge (River Mile 12) to Dobbs Ferry (River Mile 23) will be coded as STATION=12. The Hudson River north of Dobbs Ferry (River Mile 24) to Croton Point (River Mile 33) will be coded as STATION=13. The Hudson River from north of Croton Point (River Mile 34) to Grassy Point (River Mile 38) will be coded as STATION=14.

1.1.3 Trawl sample sites are located off current NOAA navigation charts using aids to navigation, soundings, bottom type, and landmarks in the river channel and shoal areas. The following site designations are used for trawl samples:

SITE = 4 west of river channel (≤20 feet of depth)
= 5 river channel (>20 feet of depth)
= 6 east of river channel (≤20 feet of depth)

1.1.4 The trawl will be deployed against the ambient current for 10 minutes (of fishing time on the river bottom) at an appropriate engine RPM in a manner which maximizes the catch of striped bass ≥150 mmTL and minimizes mortality. A wire:depth ratio of between 2:1 and 4:1 is maintained for each tow depending on river current and bottom conditions.

1.1.5 Normandeau's sampling vessel, the *R/V Pannaway* will deploy the 9m trawl. Normandeau's *R/V Woody I* will be used as a back-up vessel.

1.1.6 If a sampling day is missed due to weather, river conditions, or gear problems, the day may be rescheduled for the first Saturday following the missed day.

1.1.7 At the end of the 10 minute tow the trawl is retrieved and the cod end is carefully transferred from the water into one or more "fish totes" filled with fresh river water on the deck of the vessel. A fish tote is a plastic container measuring 28" long, 16" wide and 11" deep. The catch is then sorted into sufficient fish totes to handle the catch. For striped bass ≥ 300 mm place no more than 20 fish per tote. The water level in the fish totes should be kept full and replaced with fresh river water as needed. Striped bass and Atlantic tomcod will be processed first, except for species requiring special handling (sturgeon), which are handled as outlined in Section II-4.0. The by-catch will be processed last.

1.1.8 For catches of striped bass that exceed 100 fish and long processing times (i.e., ≥ 2 hours) are anticipated the aluminum holding tank (Figure II-1) should be used. Samples (samples containing more than 100 striped bass) collected without the use of the aluminum holding tank will have a "1" marked in the COMMENTS of the S1 Card type of the field data sheet and a note written explaining why the tank was not used (e.g. rough water conditions).

1.1.9 Each sample collected will be assigned a Use Code (1, 2, or 5) that defines its use in analytical tasks. Use Code 1 samples will be samples from which valid data were collected and no sampling problems were encountered. A Use Code 1 sample has no loss of any striped bass or Atlantic tomcod due to equipment damage, and the sample was collected as specified in Sections II-1.0 through II-1.1.8 above. Use Code 1 samples will be used for all analytical tasks. Use Code 2 samples will be collections in which tow was completed and at least one "target" fish species (striped

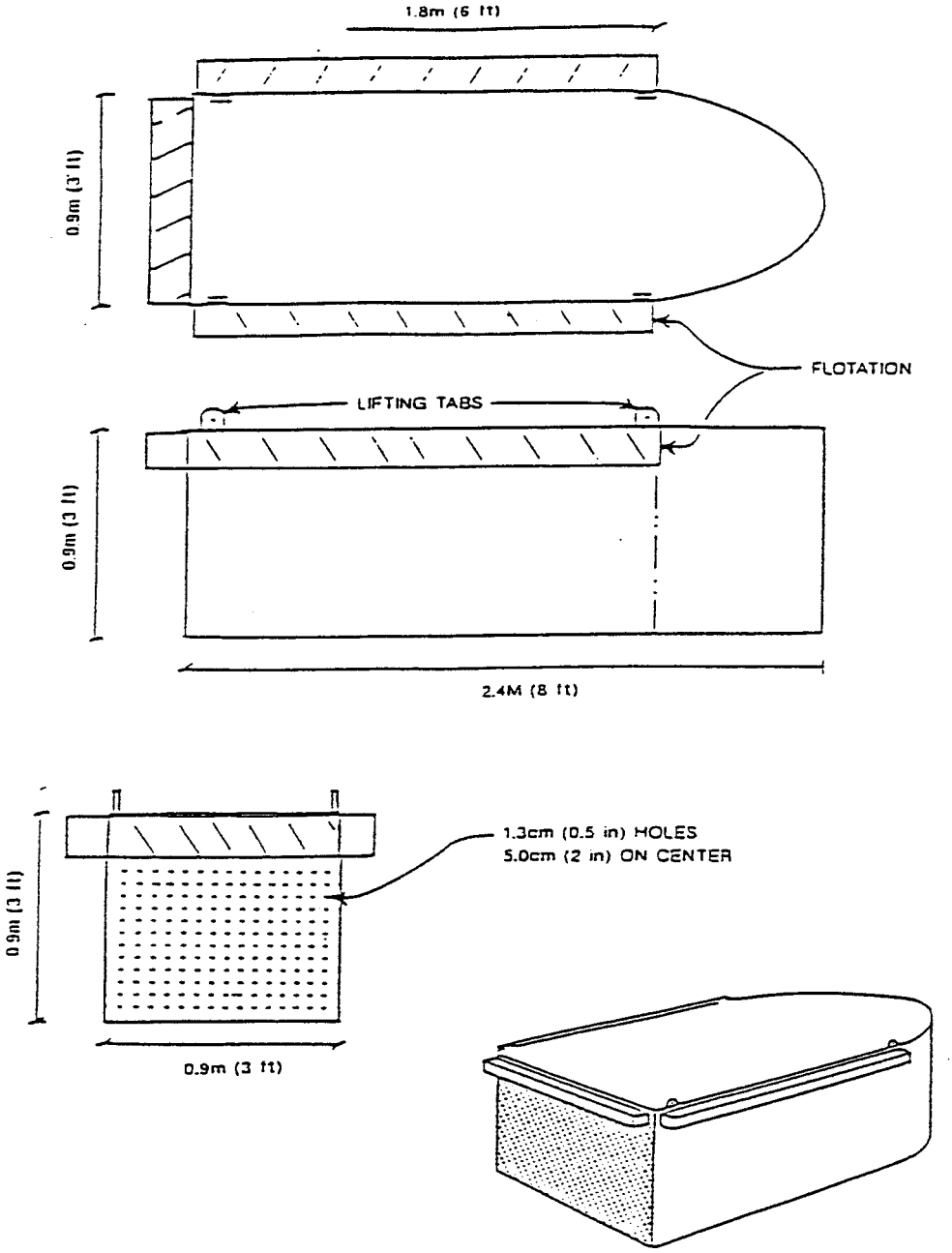


Figure II-1. Aluminum holding facility for striped bass used during the Hudson River Striped Bass and Atlantic Tomcod Program

bass, Atlantic tomcod, shortnose or Atlantic sturgeon) was captured, but sampling problems were encountered causing a deviation from the deployment procedures specified in Sections II-1.0 through II-1.1.8 above. Examples of deviations from the deployment protocols include, but are not limited to, a tow duration of less than 10 minutes, or finding a tear in the net mesh when the gear was retrieved. Use Code 2 samples will be excluded from calculations involving catch per unit of effort, length-frequency distribution, or mark-recapture abundance estimates, but would be useful for identifying and describing cross-year recaptured fish or for food habits. Use Code 5 samples are Use Code 2 samples where no target fish are caught due to failure to collect the sampling device, such as "hanging down" the net or other catastrophic failure of the sampling procedures. Use Code 5 samples will be excluded from all analysis.

USE CODE DEFINITIONS

USE CODES	DEFINITION
1	Assigned to samples when there are no sampling problems
2	Assigned to samples when sampling problems are encountered but markable striped bass, Atlantic tomcod, or species requiring special handling (Atlantic and shortnose sturgeon) are caught. All fish are processed as USE_CODE=1 samples.
5	Assigned to samples when sampling problem are encountered and no markable striped bass, Atlantic tomcod, unusual species, any species requiring special marking are caught (i.e., Void).

1.1.10 Water quality samples will be taken for each trawl sample. Temperature and conductivity will be recorded at the surface and bottom. Temperature is recorded to the nearest 0.1°C, and conductivity to the nearest scale unit using a YSI Model 85 Handheld Oxygen, Conductivity, Salinity and Temperature System (YSI 85) or the YSI Professional Plus (Section VI).

1.1.11 If catches of Atlantic tomcod in the box traps are low, supplemental trawling may be conducted with a small (16 ft) trawl (GEAR CODE= 02) in areas near the most productive box traps. These trawls will be coded by RIVER MILE and SITE.

2.0 TRAWL SAMPLE PROCESSING – STRIPED BASS

2.1 Striped bass will be removed from the holding facilities using the following procedures designed to minimize handling stress:

1. fish will be removed from the holding facility using a fine-mesh dip net or brail,
2. all surfaces that will come in contact with alive fish will be wet,
3. striped bass will never be picked up or handled by eye sockets, gill arches, isthmus, or opercular flaps,
4. struggling fish will be quieted by covering the head and eyes with a wet hand or cloth,

5. tags will be applied by personnel who have prior experience or training, and

6. all personnel handling striped bass will have wet hands or wear wet gloves.

All striped bass will be measured to the nearest mmTL.

2.2 Determine and record the release recapture status and condition of all striped bass at the time they are removed from the net. Categories will include:

RELEASE-RECAPTURE CODE (REL_REC)	ALIVE-DEAD CODE (A_D)	DESCRIPTION
1	1	Fish is alive and in good condition at time of capture and released alive; tagged if ≥150 mm TL.
1	2	Fish is in apparent good condition when released but died in water and is not recovered (e.g. predation by gulls).
2	1	Recaptured, tagged fish with a Hudson River Foundation (HRF) tag (the tag we apply). Tag legend is readable and in good condition. NOTE: good condition for the tag legend is defined as, if in the judgment of the person applying the tag, the legend would be readable if the fish was recaptured next year. Fish is released alive and in good condition.
2	2	Recaptured, tagged fish (HRF tag) is dead at time of capture or would not survive if released. The tag legend is readable and in good condition. Fish is appropriately labeled and taken to lab for autopsy.
3	1	Striped bass provided to researchers or outside agencies that were alive and in good condition at the time of collection.
3	2	As above for REL_REC=3, A_D=1 but fish were dead or in poor condition at the time of collection.
4	1	Suspected hatchery striped bass, based on a second dorsal finclip or magnetic tag detection, recaptured alive; take a scale sample, freeze or preserve fish in 70% ethanol, and take fish to lab for tag verification after proper labeling. (N/A after 1998-99).
4	2	As above (REL_REC=4) but fish is dead at time of capture or would not survive processing; take a scale sample, freeze or preserve fish in 70% ethanol, and take fish to lab for tag verification after proper labeling. (N/A after 1998-99).
5	1	Fish with apparent tag wound at the anchor tag insertion sites indicating the tag was shed or the tag was cut off. The fish is killed, labeled, and taken to the laboratory for autopsy.

RELEASE-RECAPTURE CODE (REL_REC)	ALIVE-DEAD CODE (A_D)	DESCRIPTION
5	2	As for REL_REC=5 but fish was dead at the time of capture or would not survive tagging. Fish is properly labeled and taken to lab for autopsy.
6	1	Fish is in poor condition and is tagged or released alive with or without tagging. (Note: The presence of a tag number and mark code on the data record indicated the fish was tagged).
6	2	Fish is in poor condition, and died during tagging or is eaten by gulls after release.
7	1	Same as REL_REC=2 but fish is recaptured with a different type of tag or a tag from another program (not HRF tag).
7	2	Same as REL_REC=7, A_D=1 but fish was dead at the time of capture or would not survive if released.
9	1	Same as for REL_REC=2 (recaptured) fish except the legend on the tag could not be read, or is judged unreadable if the fish is at large for another year. Cut off the unreadable tag and place in a scale envelope labeled with sample number, FISH_ID, and fish length and attach envelope to appropriate data sheet. If the illegible tag is one with a legend on the anchor, the fish should be killed, properly labeled, and taken to the laboratory for examination.
9	2	Same as REL_REC=9, A_D=1 but fish was dead at the time of capture or would not survive if released.

2.2.1 Good condition will be defined as a fish that:

1. is not bleeding from gills or body,
2. has not lost a significant number of scales,
3. shows strong opercular motion, and
4. does not exhibit gross external anatomical anomalies such as fin rot, blindness, fungus or skeletal deformities.

Fish in poor condition (REL_REC=6) will exhibit one or more of the conditions listed above.

2.2.2 Proper labeling requires that each striped bass taken to the laboratory for autopsy or for tag reading is individually placed in a plastic bag or other appropriate container and labeled with the following information:

DATE
TASK CODE
SAMPLE
FISH_ID
REL_REC
A_D
TAG NUMBER

A unique label and bag will be used for each fish taken to the laboratory.

2.3 Measure and record the total length of all striped bass in millimeters (mm TL).

2.4 Check all striped bass for external streamer tags. Any fish with external streamer tags (regardless of the agency issuing the tag) will have the tag number recorded along with comments about the condition of the tag and will be returned to the river alive if the fish is in good condition.

2.5 Determine and record if possible, the sex of live striped bass through examination of spontaneously discharged reproductive products.

2.6 Scale samples will be taken from all released striped bass ≥100 mm TL (REL_REC=1 or REL_REC=6), except for striped bass recaptured within the current program. Striped bass recaptured from previous programs will have a scale sample removed from the right side. Striped bass <100 mm are assumed to be Age 0+ and a scale sample will not be taken. For each striped bass caught that has not been previously tagged and is ≥100mm TL, take a scale sample consisting of 10-20 scales from the left side from an area midway between the lateral line and the notch between the spinous and soft dorsal fins. The tag inventory or Table II-2 should be consulted to identify tags from the current program. Special care should be taken to ensure that scale samples are not contaminated with scales from different fish. The scalpel should be wiped clean with a wet rag or sponge after each scale sample is taken.

2.7 BIRD PREDATION ON RELEASED STRIPED BASS

During periods of high bird predation, a recovery pen will be used to reduce bird predation on striped bass as they are caught, handled, and released. The pen will also facilitate individual recognition and recovery of fish that did not survive after tagging. COMMENTS in the S1 Card Type of the field data sheet will be marked with a 1 and a note will be written in the comments section for each sample collected with the use of the recovery pen. The note will explain why the pen was used.

2.7.1 All fish caught and processed during trawling will be released into the recovery pen unless the crew determines that bird predation is not likely to occur during processing of the catch.

2.7.2 During the release of fish into the recovery pen, a crew member will observe if striped bass escape from the pen and are eaten by gulls or other birds. If at all possible, identify each individual fish (by FISH_ID) that is eaten by gulls and change the A_D code from the number "1" to number "2" on the M2 card type.

2.7.3 If it is not possible to identify each individual fish lost to gull predation, a tally of the total number of tagged and untagged striped bass lost to gulls is required. For each sample where bird predation is observed, complete a taxon=333 record in the C1 card type. If no striped bass were killed by birds a zero should be placed in the CT_LC1 column. For each sample the following data will be recorded in the C1 Card Type of the field data sheet:

Record TAXON =	333 to indicate bird predation data
DIV_1, DIV_2 =	leave blank, N/A
CT_LC1=	total number of striped bass that were eaten by birds
CT_LC2=	total number of tagged striped bass that were eaten by birds
CT_LC3=	total number of untagged striped bass that were eaten by birds
CT_LC4=	total number of striped bass of unknown origin eaten by birds

2.8 STRIPED BASS TAGGING PROCEDURES (REL_REC=1 OR REL_REC=6)

Tags applied in the current program (Figure II-2) will be from consecutive blocks of numbers (Table II-2) so that recaptured striped bass from previous programs will be easily identifiable.

2.9 Tag and release all striped bass ≥150 mm TL in good condition and not already tagged.

2.9.1 Ranges of tag numbers and reward values for Floy internal anchor/external streamer tags (MARK CODE=96 or 97) and Hallprint internal anchor/external streamer tags (MARK CODE=98) are shown in Table II-2.

2.9.2 The Hallprint internal anchor/external streamer tag (MARK CODE=98) is numbered starting with 250,001 and is applied in the same location as the Floy internal anchor/external streamer tag (see Section II-2.9.1). Small Hallprint internal anchor/external streamer tags will be applied to striped bass <300 mm TL, and large Hallprint tags will be applied to striped bass ≥300 mm TL.

2.9.2.1 Striped bass will be calmed and immobilized by placing them dorsal side down on a V-shaped tagging board to fully support the fish and cover the eyes. A 1-2 mm puncture is made through the body musculature with a scalpel or dissecting needle for Hallprint tag insertion.

2.9.2.2 The tag insertion site is located on the left side of the fish approximately mid-way between the vent and the distal tips of the depressed pelvic fins and slightly off-center (5 or 6 scale rows laterally) of the mid-ventral line.

2.9.2.3 A scale is removed with the scalpel point and a puncture or small incision will be made just to the depth of, but not quite through, the peritoneum. The peritoneum will be gently punctured with the anchor of the tag as it is inserted through the incision, and the anchor of the tag will be set with a gentle pull on the streamer. The external streamer will be rotated so that the tag anchor aligns with the long axis.

2.9.2.4 Scalpel blades will be changed frequently to avoid tearing of the tissue and all incisions will be treated with a merbromine-based topical antiseptic such as Wound Control to prevent infection.

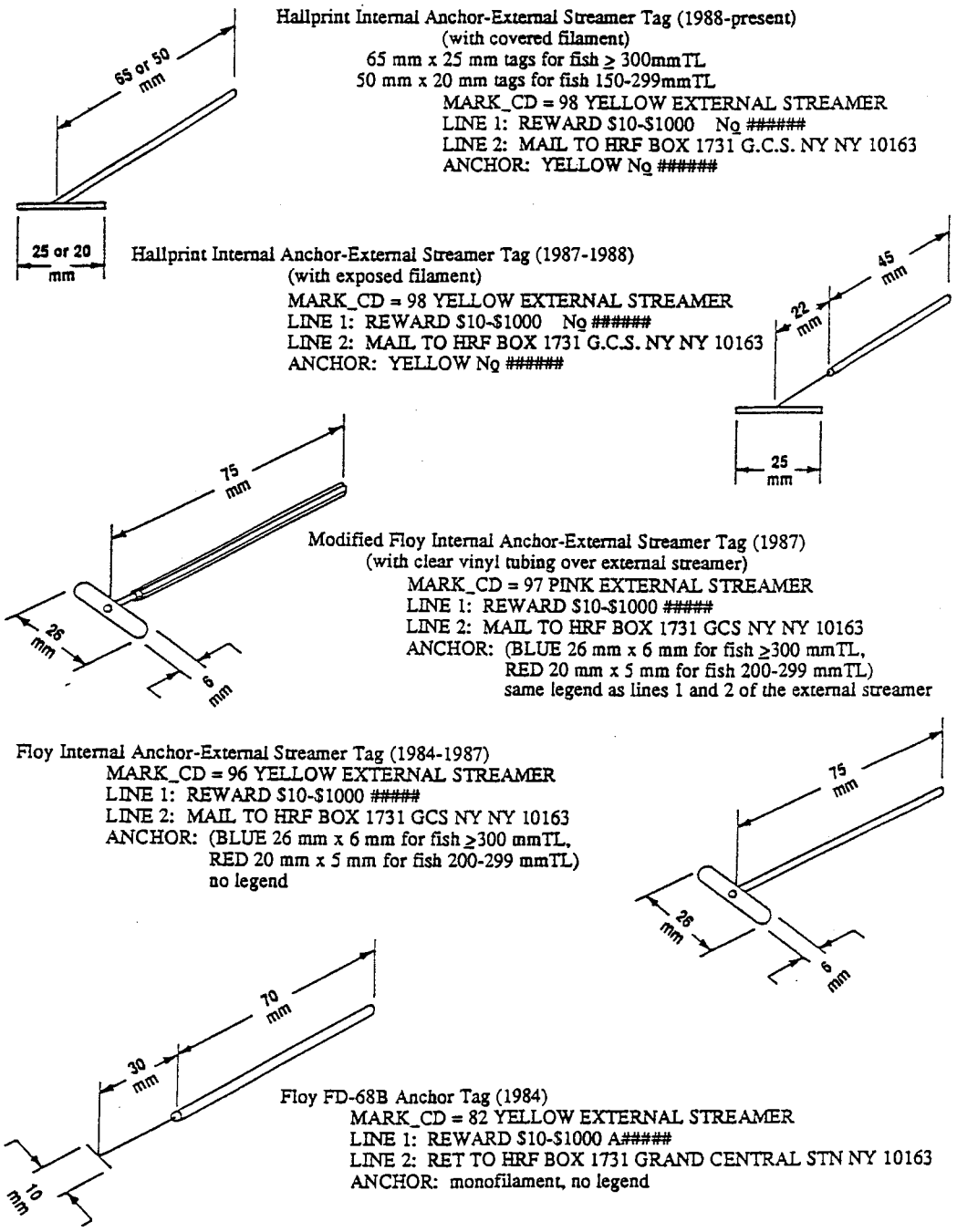


Figure II-2. Tags used to mark striped bass during the 1984-Present Hudson River Striped Bass Hatchery Evaluation Programs

Table II-2. Summary of Tag Numbers, Tag Types, and Reward Values for External Streamer Rags Used by Normandeau to Tag and Release Striped Bass in the Striped Bass Program, April 1984 - Present

Tag Numbers	Tag Type	Year(s)	Reward
1-500	Floy	1984	[a]$10
501-2500	Floy	1984, 1985-86	$10-$1000
2501-5000	Floy	1984, 1985-86 1986-87	$ 5-$1000
5001-11000	Floy	1985-86, 1986-87	$ 5-$1000
11001-22000	Floy	1985-86, 1986-87 1987-88	$ 5-$1000
22001-28500	Floy	1985-86, 1986-87 1987-88	$10-$1000
28501-32000	Floy	1985-86, 1986-87	$ 5-$1000
32001-38000	Floy	1986-87, 1987-88	$10-$1000
250,001-251,000	Hallprint	1987-88[b]	$10-$1000
251,001-251,100	Hallprint	1987-88[b]	$10-$1000
251,101-253,000	Hallprint	1987-88[b]	$10-$1000
253,001-255,000	Hallprint	1987-88[b]	$5-$1000
255,001-256,500	Hallprint	1987-88[b]	$10-$1000
256,501-257,000	Hallprint	1987-88, 1988-89[b]	$10-$1000
257,001-260,000	Hallprint	1988-89[b]	$ 5-$1000
260,001-261,500	Hallprint	1988-89[b]	$10-$1000
261,501-265,000	Hallprint	1988-89[b]	$10-$1000
265,000-270,000	Hallprint	1988-89[b]	$ 5-$1000
270,001-275,000	Hallprint	1988-89[c]	$10-$1000
275,001-280,000	Hallprint Small Tag	1988-89[c]	$ 5-$1000
280,001-285,000	Hallprint Small Tag	1988-89[c]	$10-$1000
285,001-290,000	Hallprint	1989-90[c]	$ 5-$1000
290,001-295,000	Hallprint	1989-90[c]	$10-$1000
300,001-302,500	Hallprint Small Dart Tag	1988-89, 1989-90[c]	$10-$1000
302,501-305,000	Hallprint Small Dart Tag	1988-89, 1989-90[c]	$ 5-$1000
305,001-310,000	Hallprint Small Tag	1989-90[c]	$10-$1000
310,001-315,000	Hallprint Small Tag	1989-90[c]	$ 5-$1000
315,001-319,706	Hallprint Large Tag	1989-90[c]	$10-$1000
319,707-320,000	Hallprint Large Tag	1990-91	$10-$1000
320,001-321,321	Hallprint Small Tag	1989-90[c]	$ 5-$1000
321,322-325,000	Hallprint Small Tag	1990-91	$ 5-$1000

(continued)

Table II-2. (Continued)

Tag Numbers	Tag Type	Year(s)	Reward
325,001-330,000	Hallprint Small Tag	1990-91	$10-$1000
330,001-335,000	Hallprint Large Tag	1990-91	$ 5-$1000
335,001-340,000	Hallprint Small Tag	1990-91	$10-$1000
340,001-345,000	Hallprint Small Tag	1990-91	$ 5-$1000
345,001-350,000	Hallprint Large Tag	1990-91 1991-92	$10-$1000
350,001-355,000	Hallprint Small Tag	1991-92	$ 5-$1000
355,001-360,000	Hallprint Large Tag	1991-92, 1992-93	$10-$1000
360,001-365,000	Hallprint Large Tag	1991-92, 1992-93	$ 5-$1000
365,001-370,000	Hallprint Small Tag	1991-92	$10-$1000
370,001-375,000	Hallprint Small Tag	1991-92	$ 5-$1000
375,001-380,000	Hallprint Small Tag	1992-93	$ 5-$1000
380,001-385,000	Hallprint Small Tag	1992-93	$10-$1000
385,001-390,000	Hallprint Small Tag	1992-93	$ 5-$1000
390,001-395,000	Hallprint Small Tag	1992-93, 1993-94	$10-$1000
395,001-400,000	Hallprint Small Tag	1993-94	$ 5-$1000
400,001-405,000	Hallprint Large Tag	1993-94, 1994-95	$10-$1000
405,001-410,000	Hallprint Small Tag	1993-94	$ 5-$1000
410,001-415,000	Hallprint Small Tag	1994-95	$10-$1000
415,001-420,000	Hallprint Large Tag	1994-95, 1995-96 1996-97	$ 5-$1000
420,001-425,000	Hallprint Small Tag	1994-95, 1995-96	$10-$1000
425,001-430,000	Hallprint Large Tag	1995-96, 1997-98	$ 5-$1000

(continued)

Table II-2. (Continued)

Tag Numbers	Tag Type	Year(s)	Reward
430,001-435,000	Hallprint Small Tag	1995-96, 1996-97	$10-$1000
435,001-440,000	Hallprint Large Tag	1994-95, 1995-96 1996-97	$ 5-$1000
440,001-445,000	Hallprint Small Tag	1994-95, 1995-96 1996-97, 1997-98	$10-$1000
445,001-450,000	Hallprint Large Tag	1995-96, 1996-97 1997-98	$ 5-$1000
450,001-454,000	Hallprint Small Tag	1997-98, 1998-1999	$10-$1000
454,001-458,000	Hallprint Large Tag	1998-99	$ 5-$1000
458,001-462,000	Hallprint Small Tag	1998-99	$10-$1000
462,001-466,000	Hallprint Large Tag	1998-99, 1999-00	$ 5-$1000
466,001-470,000	Hallprint Small Tag	1997-98, 1998-99 1999-00	$10-$1000
470,001-474,000	Hallprint Large Tag	1998-99, 1999-00	$ 5-$1000
474,001-478,000	Hallprint Small Tag	1998-99, 1999-00	$10-$1000
478,001-481,000	Hallprint Large Tag	1998-99, 1999-00 2000-01	$ 5-$1000
481,001-484,000	Hallprint Large Tag	1999-00, 2000-01	$10-1000
484,001-488,000	Hallprint Small Tag	1999-00, 2000-01	$ 5-$1000
488,001-492,000	Hallprint Small Tag	2000-01	$10-$1000
492,001-494,000	Hallprint Small Tag	2000-01	$ 5-$1000
494,001-496,000	Hallprint Small Tag	2000-01,2001-02	$ 10-$1000
496,001-498,000	Hallprint Large Tag	2000-01, 2001-02	$ 5-$1000
498,001-500,000	Hallprint Small Tag	2001-02	$ 5-$1000
500,001-501,000	Hallprint Large Tag	2001-02	$10-$1000
501,001-502,000	Hallprint Small Tag	2001-02	$10-$1000

(continued)

Table II-2. (Continued)

Tag Numbers	Tag Type	Year(s)	Reward
502,001-504,000	Hallprint Small Tag	2001-02	$ 5-$1000
504,001-506,000	Hallprint Small Tag	2001-02, 2002-03	$10-$1000
506,001-508,000	Hallprint Large Tag	2001-02	$ 5-$1000
508,001-510,000	Hallprint Small Tag	2002-03	$ 5-1000
510,001-512,000	Hallprint Small Tag	2001-02, 2002-03, 2003-04	$10-$1000
512,001-514,000	Hallprint Large Tag	2002-03	$10-$1000
514,001-516,000	Hallprint Small Tag	2002-03	$10-$1000
516,001-517,000	Hallprint Large Tag	2002-03	$ 5-$1000
517,001-519,000	Hallprint Large Tag	2002-03, 2003-04	$10-$1000
519,001-521,000	Hallprint Small Tag	2003-04	$ 5-$1000
521,001-523,000	Hallprint Large Tag	2003-04	$ 5-$1000
523,001-525,000	Hallprint Small Tag	2003-04	$10-$1000
525,001-527,000	Hallprint Small Tag	2004-05	$ 5-$1000
527,001-529,000	Hallprint Large Tag	2004-05	$10-$1000
529,001-531,000	Hallprint Small Tag	2004-05	$10-$1000
531,001-532,000	Hallprint Large Tag	2005-06	$ 5-$1000
532,001-533,000	Hallprint Small Tag	2005-06	$10-$1000
535,001-537,000	Hallprint Small Tag	2004-05	$ 5-$1000
537,001-539,000	Hallprint Large Tag	2005-06	$ 5-$1000
539,001-541,000	Hallprint Large Tag	2005-06	$10-$1000
541,001-542,000	Hallprint Large Tag	2005-06	$ 5-$1000
542,001-543,000	Hallprint Small Tag	2005-06	$10-$1000

(continued)

Table II-2. (Continued)

Tag Numbers	Tag Type	Year(s)	Reward
543,001-545,000	Hallprint Small Tag	2006-07	$ 5-$1000
545,001-547,000	Hallprint Small Tag	2006-07	$ 5-$1000
547,001-549,000	Hallprint Small Tag	2006-07	$10-$1000
549,001-551,000	Hallprint Large Tag	2006-07	$10-$1000
551,001-553,000	Hallprint Small Tag	2006-07, 2007-08	$ 5-$1000
553,001-554,000	Hallprint Large Tag	2007-08	$ 5-$1000
554,001-555,000	Hallprint Large Tag	2007-08	$ 5-$1000
555,001-556,000	Hallprint Small Tag	2007-08	$ 5-$1000
556,001-557,000	Hallprint Small Tag	2007-08	$ 5-$1000
557,001-558,000	Hallprint Small Tag	2007-08	$10-$1000
558,001-559,000	Hallprint Small Tag	2007-08	$10-$1000
559,001-560,000	Hallprint Large Tag	2007-08	$10-$1000
560,001-561,000	Hallprint Large Tag	2007-08, 2008-09	$10-$1000
561,001-562,000	Hallprint Small Tag	2007-08, 2008-09	$ 5-$1000
562,001-563,000	Hallprint Small Tag	2008-09	$ 5-$1000
563,001-564,000	Hallprint Small Tag	2008-09	$ 5-$1000
564,001-565,000	Hallprint Large Tag	2008-09	$ 5-$1000
565,001-566,000	Hallprint Small Tag	2008-09	$10-$1000
566,001-567,000	Hallprint Small Tag	2008-09	$10-$1000
567,001-568,000	Hallprint Large Tag	2008-09	$ 5-$1000
568,001-569,000	Hallprint Small Tag	2008-09	$ 5-$1000
569,001-570,000	Hallprint Large Tag	2008-09	$ 5-$1000

(continued)

Table II-2. (Continued)

Tag Numbers	Tag Type	Year(s)	Reward
570,001-571,000	Hallprint Large Tag	2008-09	$ 5-$1000
571,001-572,000	Hallprint Small Tag	2008-09	$10-$1000
572,001-573,000	Hallprint Large Tag	2008-09	$10-$1000
573,001-574,000	Hallprint Small Tag	2009-10	$10-$1000
574,001-575,000	Hallprint Small Tag	2009-10	$10-$1000
575,001-576,000	Hallprint Large Tag	2009-10	$ 5-$1000
576,001-577,000	Hallprint Small Tag	2009-10	$ 5-$1000
577,001-578,000	Hallprint Small Tag	2009-10	$ 5-$1000
578,001-579,000	Hallprint Small Tag	2009-10, 2010-11	$ 5-$1000
579,001-580,000	Hallprint Large Tag	2009-10, 2010-11	$ 5-$1000
580,001-581,000	Hallprint Large Tag	2010-11	$ 5-$1000
581,001-582,000	Hallprint Small Tag	2010-11	$ 5-$1000
582,001-583,000	Hallprint Small Tag	2010-11	$ 5-$1000
583,001-584,000	Hallprint Small Tag	2010-11	$10-$1000
584,001-585,000	Hallprint Small Tag	2010-11	$10-$1000
585,001-586,000	Hallprint Large Tag	2010-11	$10-$1000
586,001-587,000	Hallprint Large Tag	2011-12	$10-$1000
587,001-588,000	Hallprint Small Tag	2011-12	$10-$1000

[a] Two types of tags were placed in each fish during 1984. Mark_Code 82 is a Floy, Dennison style t-bar tag that was inserted between the first and second dorsal fins. Mark_Code 82 tags have numbers 1-5000 with letter A as a prefix. Mark_Code 96 is a Floy internal anchor external streamer tag inserted into the abdomen. Mark_Code 96 tags have the same numbers as Mark_Code 82 tags (1-5000) but have the letter B as a prefix. See Figure II-2.

[b] Hallprint Mark Code=98 tags from numbers 250,001 through 270,000 have an exposed filament at the base of the external streamer. Hallprint Mark Code 98 tags with numbers greater than 270,000 have the external streamer extended to the base of the anchor, which leaves no exposed filament. Small tags have a small anchor and filament, large tags have a large anchor and filament. See Figure II-2 for anchor and filament dimensions.

[c] Some fish were double-tagged in 1988-89 and 1989-90 with a Hallprint small dart tag (Mark Code=95) placed in a dorsal location midway between the first and second dorsal fins, and a Hallprint internal anchor tag (Mark Code=98) inserted in the abdomen.

2.9.3 Floy internal anchor/external streamer tags should not be applied during the present program. Tag application will be the last stage of processing and fish that develop signs of stress during handling will not be tagged.

2.10 All striped bass will be released into a recovery pen deployed in the water at the side of the tagging vessel if bird predation is present. Fish will be released into this pen where they can recover from initial handling shock and then swim out into the river through the open bottom. Fish which do not recover can be retrieved with a dip net. The use of this recovery pen will also facilitate recognition of individual fish that do not survive tagging, and it may help prevent bird predation on temporarily stunned fish.

2.10.1 The recovery pen is a 1mX1mX2m rigid-framed cage with 1 cm (stretch) mesh netting on the sides. The top and bottom of the recovery pen are open and the pen is fastened to the boat with ropes so that the 2m dimension runs parallel to the side, and the top of the pen frame is just above the water surface.

2.10.2 Individual striped bass are released into the holding facility after they have been tagged. Any stressed striped bass remaining in the recovery pen after the entire sample has been processed will be removed with a dip net, properly labeled, and taken to the laboratory for autopsy. Each fish recovered from the pen will have the alive/dead code changed to A_D = 2 on the M2 card type. The tag will be left in the fish, and the tag number, REL_REC and other data on the M2 Card Type will remain unchanged for all fish recovered from the pen.

2.11 Place all dead (A_D=2) striped bass in plastic bags with labels and take them to the lab for processing if the fish was tagged and released into the holding pen, but died in the pen and was recovered. A copy of the Field Data Sheet should be provided to the lab with each dead fish.

2.12 TAGGED STRIPED BASS RECAPTURES (REL_REC=2, 7 OR 9)

2.12.1 For all tagged, recaptured striped bass an M2 card type should be filled out.

2.12.2 Codes for condition of the tag insertion site include:

TAG COND	DESCRIPTION
1	Tag present, wound healed.
2	Tag present, wound poorly healed, evidence of infection or swelling at insertion site.

2.12.3 Recaptured, tagged striped bass that are alive and in good condition are released without application of additional tags, regardless of the origin of the tag. (This applies to HRF tags and tags applied by other groups e.g. Littoral Society). However, if the HRF tag legend is judged unreadable if the fish is recaptured one year later, the old tag should be cut off and the fish is released without tagging unless the tag legend is printed on the anchor. If the illegible tag is one with Mark Code=97 or 98 there will be a legend on the anchor. Fish with legends on the anchor should be killed, properly labeled, and taken to the laboratory for examination.

2.12.4 Scales are to be taken from all recaptured striped bass from previous programs but not from striped bass recaptured from the current program. Consult the tag number inventory in Table II-2 to

determine if the fish is a current or previous program recapture. If in doubt, take a scale sample. Take a sample of 10-20 scales from the right side of all recaptured striped bass since a scale sample from the left side may result in many regenerated scales. Scales are taken from an area midway between the lateral line and the notch between the spinous and soft dorsal fins.

2.12.5 All recaptured striped bass (REL_REC=2, 7 or 9) will have data collected regarding the condition of the legend on the tag, the orientation of the legend, and whether or not anchor protusion has occurred. These data will be recorded on the M2 card type as follows:

TAG VARIABLE	COMMENT CODE	COMMENT DESCRIPTION
Number	1,2,3 or 4	1=Legend completely missing
Address	1,2,3 or 4	2=Abraded and partly missing
Reward	1,2,3 or 4	3=Abraded but completely legible
		4=Completely legible
Number orientation	1 or 2	1=Tag number facing anterior (Head)
		2=Tag number facing posterior (Tail)
Anchor protrusion	1 or 2	1=Yes 2=No

Please note that the tag number orientation refers to which side of the fish the tag number is found. If the orientation is anterior (=1), the tag number will be found on the leading edge of the tag streamer as the fish swims through the water, thus exposing the tag number to possible abrasion. If the tag number orientation is posterior (=2), the tag number is found on the trailing side of the tag as the fish swims through the water. Intermediate positions of the tag number should always be classified as an orientation of 1 or 2 based on the judgment of the field crew.

2.12.6 All recaptured striped bass (REL_REC=2, 7 or 9), all fish with suspected tag wounds (REL_REC=5), and all fish in poor condition or injured (REL_REC=6) will have data recorded on the M2 card type relating to the nature of the injuries. These data will be recorded by type of injury as follows:

VARIABLE	CODE	
BLIND	1 =	blind in one eye
	2 =	blind in both eyes
	blank =	not blind
FUNGUS	1 =	Fungus on part or all of one side of body
	2 =	Fungus on part or all of both sides of body
	blank =	No fungus observed
FINROT	1 =	On caudal fin
	2 =	On pectoral fin(s)

VARIABLE	CODE	
	3 =	On pelvic fin(s)
	4 =	On anal fin
	5 =	On dorsal fin(s)
	6 =	Multiple fins
	blank =	no fin rot observed
SKELETON	1 =	Scoliosis (side to side curvature of the spine)
	2 =	Lordosis (top to bottom curvature of the spine)
	3 =	Head abnormalities (eg. pugnose)
	4 =	Fish hook damage
	blank =	no skeletal abnormalities observed
STRESS	1 =	Net rash
	2 =	Crushed
	3 =	Handling stress
	blank =	no signs of stress observed
OTHER	1 =	other injury or abnormality not described in the categories presented on the data sheet. Please provide a written description of the injury or abnormality in the comments section of the data sheet.

2.12.7 Striped bass tagged with Hallprint tags (MARK_CD=98), or pink HRF tags (MARK_CD=97) have the tag number printed on the streamer and internal anchor. Recaptured striped bass with Hallprint tags or pink HRF tags that are judged to have unreadable tag numbers (REL_REC=9) should be sacrificed, properly labeled, and taken to the laboratory to read the tag number on the internal anchor.

2.12.8 All striped bass with suspected tag wounds should be taken to the lab. Fish should be placed individually in a plastic bag. Information on the label should include Sample Number, Date and Fish ID.

2.13 SUSPECTED HATCHERY STRIPED BASS (REL_REC=4)

Striped bass are no longer checked for magnetic, coded wire tags using magnetic detectors.

2.14 STRIPED BASS WITH SUSPECTED TAG WOUNDS (REL_REC=5)

All striped bass with wounds in the vicinity of the tag insertion site (see Section II-2.9.2.2) should be killed, properly labeled and taken to the laboratory for autopsy. The laboratory autopsy will determine if a tag anchor is present and read the tag number on the anchor.

2.15 STRIPED BASS IN POOR CONDITION (REL_REC=6)

Tag and release all REL_REC = 6, A_D = 1 (alive) striped bass that are 150 mm TL or longer with an internal anchor tag. The entire M2 Card Type record is completed for each REL_REC = 6 fish.

2.15.1 Small REL_REC = 6 fish less than 150 mm TL, and fish that exhibit excessive handling stress, net rash, or physical damage due to the net or handling procedures will be released without a tag after the M2 data are recorded.

2.16 PROCESSING OF BI-CATCH

216.1 After all sturgeon, striped bass and Atlantic tomcod have been processed the remaining fish in the sample are sorted, identified and counted according to the following four length classes (total length), and recorded on the C1 Card Type of the Field Data Sheet (Figure II-7).

Length Class 1 – less than or equal to the young-of-the-year length limit ("Division 1").

Length Class 2 – greater than Division 1 and less than or equal to the yearling length limit ("Division 2").

Length Class 3 – greater than Division 2 and less than or equal to 250 mm.

Length Class 4 – greater than 250 mm.

3.0 TRAWL SAMPLE PROCESSING – ATLANTIC TOMCOD

All Atlantic tomcod are measured and the individual length is recorded in the field data sheet to the nearest mm TL. Subsequent data processing will categorize tomcod lengths into length groups (Table II-3) and length classes (Table II-4). All Atlantic tomcod are checked for visual implant tags. Any suspected recaptures are handled as outlined in Sections II-3.1.1 through II-3.2. Beginning in 2003-04 all Atlantic tomcod examined for visual implant tags in the trawl samples will also be examined for external parasites before they are released (Section II.3.3). Species requiring special consideration are handled as outlined in Section II-4.0. Atlantic tomcod will not be tagged from the trawl program south of the George Washington Bridge (River Mile 11, except in low population years when directed by the Project Management).

3.1 All Atlantic tomcod are checked for prior tags or tag wounds.

Table II-3. Atlantic Tomcod Length Groups

Length Group	Millimeter Range (Total Length)
1	≤125
2	126-150
3	151-175
4	176-200
5	201-225
6	226-250
7	251-275
8	≥276

Table II-4. Atlantic Tomcod Length Classes

Length Group	Millimeter Range (Total Length)
1	0-Division I
2	Division I+1-Division II
3	Division II+1-250
4	≥251

	Total Length in Millimeters	
Sampling Date	**Division I**	**Division II**
31 Oct–04 Dec 2011	160	260
05 Dec–11 Dec 2011	200	275
12 Dec–18 Dec 2011	210	275
19 Dec–31 Dec 2011	225	290
01 Jan 2012–07 April 2012	20	225
08 April 2012–21 April 2012	50	225

NOTE: If Division II is >250 then LC3 does not exist and LC4 becomes Division II. Therefore, LC3 does not exist before 01 Jan 12.

3.1.1 All Atlantic tomcod suspected to be recaptures in the trawl program are assigned a unique fish_ID and recorded individually as recaptures (REL_REC=2 or 5) on the M2 card type, and taken to the laboratory for tag verification. MARK_CD should not be recorded. Length should be recorded. Fish recovered from the present box trap program are recorded as REL_REC=2. Fish recovered from previous programs are recorded as REL_REC=5.

3.1.2 All Atlantic tomcod recaptured by the trawl (REL_REC=2 or 5) should be placed in individual plastic bags and labeled as to Sample, Date, Fish ID and REL_REC. Laboratory personnel should be provided with copies of the M2 field data sheet.

3.2 SUSPECTED ATLANTIC TOMCOD RECAPTURES

3.2.1 All Atlantic tomcod caught in the 9 m trawl which may be recaptures from the current box trap survey are taken to the lab fresh or frozen for verification. These fish are assigned a REL_REC=2 and an A_D of 1 or 2 depending on their alive/dead status at the time of capture (1=Alive, 2=Dead).

3.2.2 All Atlantic tomcod which may be visual implant tag recaptures from previous surveys are taken to the lab fresh or frozen for verification. These fish are assigned a REL_REC=5 and an A_D of 1 or 2, depending on their alive/dead status at the time of capture (1=Alive, 2=Dead). REL_REC=5 should not be used for Atlantic tomcod other than fish recaptured from previous years' programs.

3.2.3 If a marked fish is recaptured under unusual circumstances, e.g., washed ashore dead, killed by a predator, boat, etc., or given to the crew by a person who doesn't know the origin of the fish, the fish is placed in a sample jar with 10% formalin and the necessary recapture labels should include a description of the circumstances under which the fish was collected.

3.2.4 When other contractors recapture Normandeau marked fish and give the information to Normandeau crews in the field, the applicable gear code is used. (See gear code list in the Con Edison Data Dictionary).

EXAMINATION OF ATLANTIC TOMCOD FOR EXTERNAL PARASITES

All Atlantic tomcod caught in the 9 m trawl are inspected for external parasitic infestations before they are released. On the M2 card of the field data sheet in the "PARASITE" column, the degree of external parasitic infestation will be described with the following codes:

2 = none
3 = light (1-5 external parasites)
4 = moderate (6-20 external parasites)
5 = heavy (>20 external parasites)
blank = not examined

3.4 LABORATORY FISH

The objective of laboratory processing Atlantic tomcod collected by trawls is to obtain biocharacteristics information for the spawning population. Each week, a minimum of 3-4 randomly selected samples totaling at least 100 Atlantic tomcod from one of the first two days of trawling with the 9 m trawl will be taken to the lab for biocharacteristics work-up (Section VII). If the tomcod catch is light, several days' catch may be needed to obtain a sample of 100 fish from each week's trawling program. Fish from each biocharacteristics sample will be placed in a plastic bag and labeled as to Task_CD, SAMPLE, DATE, TIME, RIV_MILE and SITE. The fish will be stored on board in a location where they will not be damaged and will be kept cool. Bio-characteristics samples will be coded with a SAM_NARR=1. The C1 and M2 card types of the field data sheet will not be coded by field personnel. Upon return to the lab, the biocharacteristics sample will be placed in a working refrigerator and the field data sheet for the biocharacteristics samples will be provided to lab personnel. Laboratory personnel will complete the daily tally sheet for trawl biocharacteristics samples. The C1 and M2 card types will be generated by computer from the SA1 card type that is completed in the laboratory (see Section VII-4.2).

3.4.1 Atlantic tomcod samples may also be provided to other groups for research purposes. These fish are examined for marks, processed, and assigned REL_REC=6 and an "A_D" (Alive_Dead) code of 1 (alive) or 2 (dead) describing their condition at the time of capture.

4.0 SPECIES REQUIRING SPECIAL HANDLING

Shortnose sturgeon (*Acipenser brevirostrum)* and Atlantic sturgeon (*Acipenser oxyrhynchus*) are two fish species requiring special handling during both the striped bass and Atlantic tomcod programs. Shortnose sturgeon is a federally listed endangered species and subjected to protection under the Endangered Species Act and State (NY and NJ) scientific Collectors Permits (see Section I, Figure I-1). All of the Hudson River field sampling activities with respect to the capture and handling of shortnose sturgeon are governed by the provisions of "Permit To Take Protected Species For Scientific Purposes" Permit No. 1580-01 that is administered by the National Marine Fisheries Service (see Appendix 4 of this SOP for a copy of Permit No. 1580-01), which expires on 31 March 2012. The New York Department of Environmental Conservation has also expressed interest in the management of both shortnose and Atlantic sturgeon found within the Hudson River estuary, New York Harbor, and adjacent waters, and specimens of both species have been marked and released with a variety of tags including Passive Integrated Transponder (PIT) tags and Carlin-Ritchie tags. All sturgeon caught will be examined for the presence of these tags and other marks. Therefore, both shortnose and Atlantic sturgeon are considered species requiring special handling during the striped bass and Atlantic tomcod programs.

4.1 TAXONOMY

Three different external features will be used to distinguish shortnose and Atlantic sturgeon in the field:

1. the mouth width to eye distance ratio,
2. the presence or absence of bony plates (scutes) found between the base of the anal fin and the midlateral line, and
3. the presence of one or two rows of scutes found along the dorsal midline posterior to the dorsal fin, and along the ventral midline anterior to the anal fin.

To identify the correct sturgeon species, first the ratio of the mouth width to the distance between the eyes is calculated. A shortnose sturgeon has a relatively large mouth compared to an Atlantic sturgeon (see Figure II-3). Shortnose sturgeon are reported to exhibit a mouth width to eye distance ratio of greater than 62% (typically 63% to 81%, Musick in Collette and Klein-MacPhee, 2002). An Atlantic sturgeon has a smaller mouth and exhibits a mouth width to eye distance ratio of less than 62% (typically 43% to 66%, Musick in Collette and Klein-MacPhee, 2002). The mouth width in mm is measured with calipers inside of the lips. The distance between the eyes in mm is also measured with calipers. The ratio of the mouth width to the distance between the eyes is calculated by taking the measured mouth width and dividing it by the eye width and multiplying by 100 to express the number as a percentage. For example, if the measured mouth width is 47 mm and the measured eye width is 64 mm, then ratio is 47/64 = 0.734 * 100 = 73.4%, and this fish is likely to be a shortnose sturgeon.

Because there is some overlap between the range of mouth widths to eye width ratios reported for some Atlantic sturgeon (62% to 66% for both species, Musick in Collette and Klein-MacPhee, 2002), a second characteristic must also be used to distinguish the two sturgeon species. The presence or absence of bony plates (scutes) above the anal fin will also be used to distinguish shortnose and Atlantic sturgeon. If two to six scutes at least as large as the pupil of the eye are found above the anal

fin in the space between the base of the anal fin and the midlateral row of scutes (see Figure II-3), then the sturgeon is an Atlantic sturgeon. If no scutes are found between the base of the anal fin and the midlateral row of scutes, the sturgeon is a shortnose sturgeon.

A third characteristic can also be used to verify the sturgeon species identification based on the mouth to eye ratio and the presence or absence of anal fin scutes. This is the presence of a single or double row of scutes in the post-dorsal or pre-anal portions of the body (Smith 1985). Looking at the dorsal (top) surface of the fish, an Atlantic sturgeon will have two rows of scutes between the posterior edge of the dorsal fin and the anterior edge of the caudal fin, one row on either side of the mid-dorsal line. Turning the fish over and looking at the ventral (belly) area between the anterior edge of the anal fin and the pelvic fins, an Atlantic sturgeon will also have two rows of scutes, one row on either side of the mid-ventral line. If the fish is a shortnose sturgeon, it will have a single row of scutes in both the post-dorsal and pre-anal areas, with this row aligned directly down the mid-line. In some shortnose sturgeon, particularly on smaller specimens, the post-dorsal row of scutes may be almost completely absent. A comparison of these distinguishing features is shown in the following table:

Species	Mouth/Eye Ratio	Anal Fin Lateral Scutes	Post-Dorsal Scutes	Pre-Anal Scutes
Atlantic Sturgeon TAXON = 29	<62%	2 to 6 bony plates present	Double row	Double row
Shortnose Sturgeon TAXON = 27	>62%	Absent	Single row or absent	Single row

4.2 ATLANTIC AND SHORTNOSE STURGEON PROCESSING PROCEDURES

4.2.1 Every effort should be taken to release shortnose sturgeon alive according to the conditions of the "Permit To Take Protected Species For Scientific Purposes" Permit No. 1580-01 (see Appendix 3 of this SOP). If, in this judgment of the principal investigator or co-investigator, complete processing of Atlantic or shortnose sturgeon is likely to endanger the survival of the fish, the minimum processing of identification to species will be performed and the fish will be released with a comment made on the data sheet describing the reasons why full processing was not completed.

4.2.2 Taxonomic features used to distinguish shortnose and Atlantic sturgeon will be documented on the M1 Card Type (Section II-5.2.7 of this SOP) under the variables EYE WIDTH, MOUTH WIDTH, MOUTH/EYE RATIO, LATERAL ANAL SCUTES, POST-DORSAL SCUTES, and PRE-ANAL SCUTES. Check the data recorded for these variables recorded against the table in Section 5.6 to be sure that all values agree with the assigned taxon code.

4.2.3 Check all Atlantic sturgeon and shortnose sturgeon for external and internal magnetic tags and record all pertinent data on the M1 data sheet. Cornell University tagged sturgeon (Atlantic and shortnose) greater than 200 mm in 1993 and 1994 with two yellow USFWS Floy tags, one at the base of the left pectoral fin and the other at the anterior base of the dorsal fin. Atlantic sturgeon between 60 and 140 mm were also tagged with magnetic tags and released in Newburgh Bay in October of 1994. Tags were inserted in either the head region or under the 4th dorsal scute.

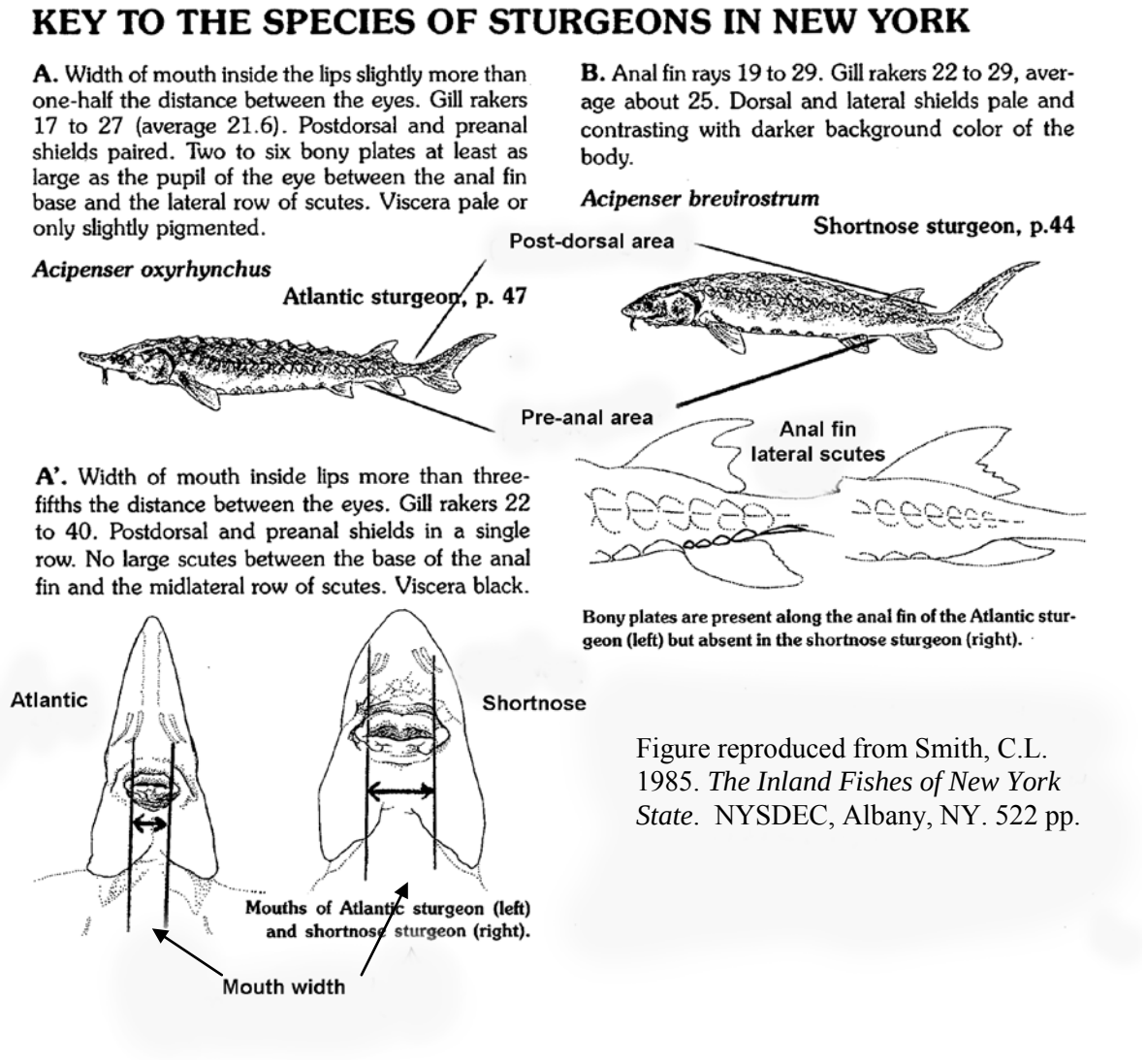


Figure reproduced from Smith, C.L. 1985. *The Inland Fishes of New York State*. NYSDEC, Albany, NY. 522 pp.

Figure II-3. Distinguishing taxonomic features of Hudson River Atlantic sturgeon and shortnose sturgeon (from Smith 1985)

4.2.4 Scan the sturgeon for a passive integrated transponding (PIT) tag that may lie anywhere under the first 7 or 8 dorsal scutes and an external Carlin-Ritchie disc dangler tag inserted through the dorsal fin. If a recaptured sturgeon is found with a tag present, record the tag number or numbers on the M1 data sheet and continue with the next step.

4.2.5 Length (mm total length), weight (grams), condition at time of capture (alive or dead), and sex if readily apparent, are determined and recorded on the M1 Card Type for each sturgeon caught.

4.2.6 Obvious abnormalities (e.g., fin rot) are noted in the comments section of the field data sheet.

4.2.7 Each sturgeon caught will be examined for the presence of external tags or marks, and scanned with a hand-held PIT tag reader to determine the presence of internal PIT tags. Each

sturgeon caught with a tag present will be assigned a REL_REC = 2 and have the tag number or description of the mark recorded on the M1 Card Type. A comment will also be written to describe the condition of the tag insertion site will be made for each recaptured sturgeon caught.

4.2.8 Each sturgeon 250 mm or smaller and each sturgeon recaptured with one or more tags present will have three photographs taken. The purpose of taking photographs of the smaller sturgeon is because there may be more variability in small fish in the taxonomic characteristics recorded for each species, and the photographs will be used to document this variability. Recaptured fish will be photographed because of their importance to the management program. The three photographs (digital images) taken for each sturgeon will include:

4.2.9 a close up of the eyes with mm ruler for scale,

4.2.10 a close up of the mouth with mm ruler for scale, and

4.2.11 a close up side view of base of anal fin to reveal presence or absence of anal scutes.

4.2.12 TASK_CD, SAMPLE, FISH_ID, TAXON, DATE, TIME, RM and SITE will be written on a paper label and included within the field of view of each photograph taken.

4.2.13 If the Atlantic or shortnose sturgeon (larger than 250mm) has not been previously tagged process as follows. Sturgeon smaller than 250mm are not tagged. Use a large holding container with a flow through water supply to keep the sturgeon in, between the many long steps. Handling time on sturgeon must not exceed 15 minutes.

4.2.14 Put a Carlin-Ritchie disc dangler tag in the fleshy part of the dorsal fin. (Figure II-4). Insert two needles through the fleshy area and sticking the wire ends of the Carlin-Ritchie disc dangler tag through the needles, thus pulling the needles out along with the wire ends back through. Twist the wire ends together, cutting the excess part off, and then bend the twist part back so that it does not rub on the sturgeon.

4.2.15 Insert a PIT tag with the big hypodermic needle under the 3rd or 4th dorsal scute by first puncturing in a fleshy area and then positioning the needle to push up underneath the scute (Figure II-4). Scan the sturgeon with the PIT tag detector and record the number of the 10 digit PIT tag and the 5 digit Carlin-Ritchie disc tag on the M1 data sheet.

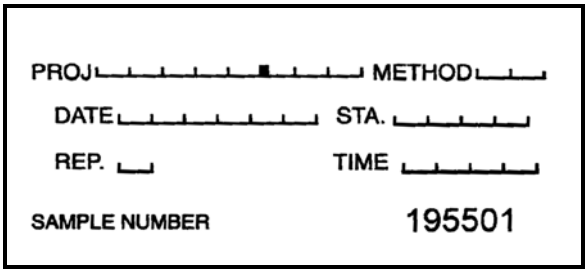
4.3 ATLANTIC AND SHORTNOSE STURGEON TISSUE SAMPLING

4.3.1 Before a tagged Atlantic or shortnose sturgeon is released a tissue sample for Genetic Analysis will be collected following the protocol described in Figure II-5. Previously tagged Atlantic or shortnose sturgeon will not have a genetic sample taken.

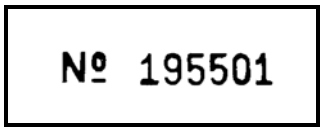
4.3.2 For genetic samples cross contamination must be avoided. For each fish sampled use a new pair of latex gloves and scalpel blade for cutting and handling the sample. If contamination occurs DISCARD the sample.

4.3.3 Place a 1 cm^2 clip of pelvic fin section in a vial with the preservative (95-100% ethanol). Be sure to use ethanol that has not been denatured with methanol or other chemical additions.

4.3.4 Label fish tissue vial using a waterproof pen (Sharpie) with sample number and fish ID number. Then place properly closed vial in a small Ziploc bag labeled with an Internal and External label (see examples of external and internal labels for sample number 195501 shown below).



External Label



Internal Label

4.3.5 Place Ziploc bag containing tissue sample vial in a cooler on ice. Upon returning to the laboratory the tissue samples are to be kept refrigerated until shipped to NOS as specified in Figure II-5.

4.3.6 Record on the M1 data sheet (Figure II-8) that a tissue sample was taken.

4.3.7 Complete a "Certification of species Identification" form (Figure II-6). This form states that the sampler personally identified the sturgeon from which the sample was taken. **If there is any doubt about the identification of a sturgeon , then do not take a tissue sample for Genetic Analysis.**

4.3.8 Make sure you let the sturgeon recover in the holding container before releasing.

4.3.9 Gently release the sturgeon when sufficiently recovered.

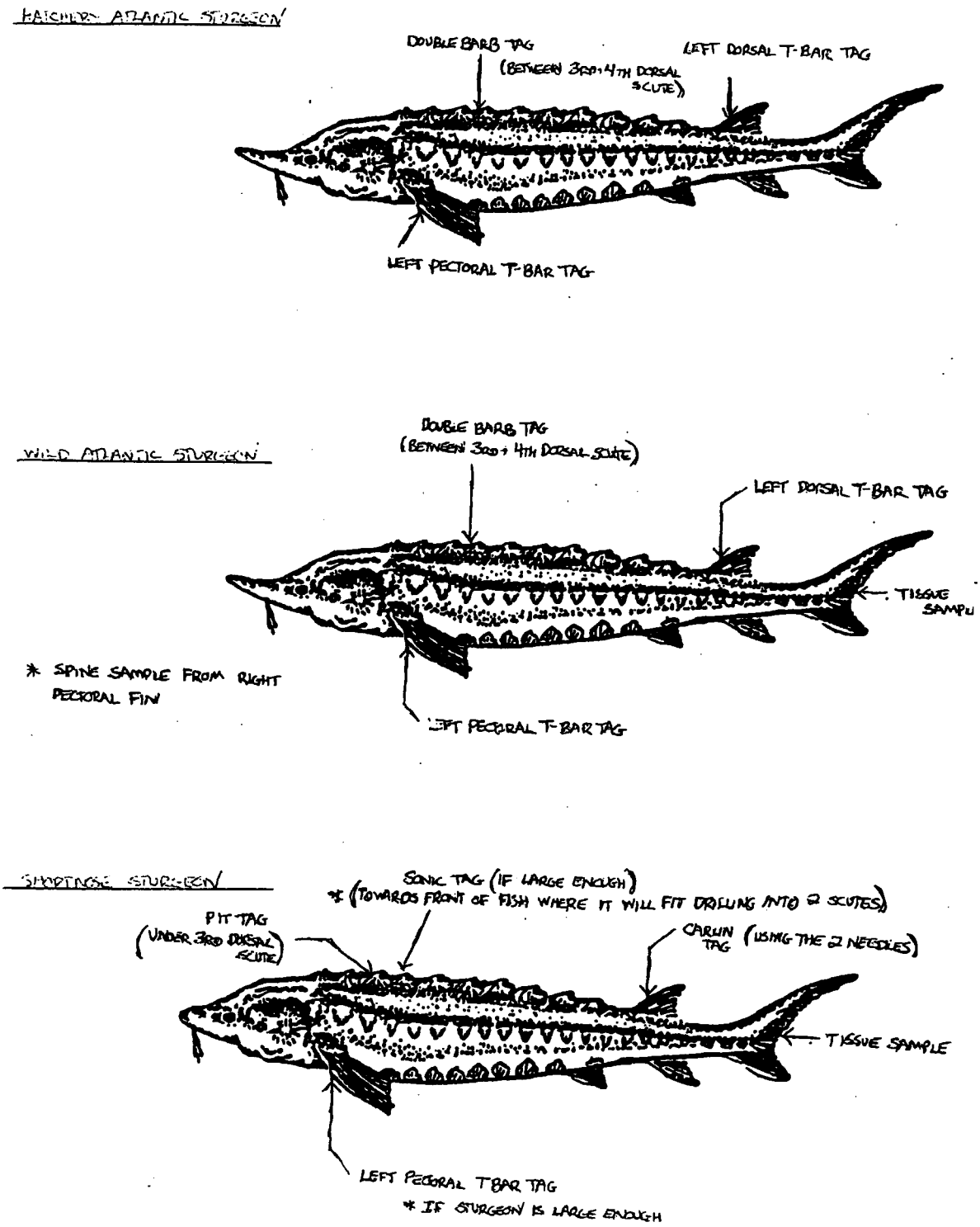


Figure II-4. Tag placement on Atlantic and Shortnose sturgeon

Instructions: Collecting, Certifying, Identifying &Shipping Tissue Samples Collected from Sturgeon.

1. **Species Certification**:
For each shipment a "*Certification of Species Identification*" (Section A) must be provided. This form documents the collector has identified the fish or fishes sampled in the shipment as either a shortnose or Atlantic sturgeon. If there is any doubt about the identity of a sample, then mark unknown and include comments on the take.

2. **Sample Identification**:
Assign a unique number identifying each individual fish captured and subsequently sampled. This number must be recorded in Section B and on the collection vial for each sample taken. Record tissue type; preservative used; date of capture; location of capture (river & description, lat/long, river km, and nearest city); length of specimen; weight; and sex, if known. Check the box provided if you are submitting multiple samples, and provide a hard-copy and/or email a copy of the sample spreadsheet with information for each of the data fields listed above.

3. **Tissue Sampling Instructions:**
a. Cleanliness of Samples: Cross contamination should be avoided. For each fish, use a clean cutting tool, syringe, etc. for collecting and handling samples.

b. Preserving & Packaging Samples:
i. Label vial with fish's unique ID number.
ii. Place a 1-2 cm^2 section of pelvic fin clip in vial with preservative (95% absolute ETOH (un-denatured), recommended).
iii. Seal individual vials or containers with leak proof positive measure (e.g., tape).
iv. Package vials and absorbent within a double sealed container (e.g., zip lock baggie).
v. Label air package properly identifying ETOH warning label (**See Appendix 3c**).

c. Shipping Instructions:
When shipping samples, place separately Appendix 3a, 3b and 3c (Sample ID and Chain of Custody Forms and Shipping Training Form) in container and seal the shipping box to maintain the chain of custody. (Note: A copy of the ESA permit authorizing the collection of the sample(s) must also accompany the sample(s)).

Important Notice: You must be certified before shipping tissue samples preserved with 95% ETOH in "excepted quantities" (A Class 3 Hazardous Material Due to Flammable Nature). See Appendix 3c: "NMFS Guidelines for Air-Shipment of Excepted Quantities of Ethanol Solutions" to comply with the DOT/IATA federal regulations.

4. **Chain of Custody Instructions:**
The "*Chain of Custody*" (Section C) should be maintained for each shipment of tissue samples and must accompany the sample(s) at all times. To maintain the chain of custody, when sample(s) are transferred, the sample(s) and the documentation should be packaged and sealed together to ensure that no tampering has occurred. All subsequent handlers breaking the seal must also sign and document the chain of custody section.

5. **Contact Information**:
A. NMFS, Office of Protected Resources:
i. **Primary Contact**: Malcolm Mohead (malcolm.mohead@noaa.gov) Phone: 301/713-2289
ii. **Primary Contact:** Colette Cairns (colette.cairns@noaa.gov) Phone: 301/713-2289
i. **Secondary Contact: (Northeast)** Jessica Pruden (jessica.pruden@noaa.gov) Phone: 978/281-9300
ii. **Secondary Contact: (Southeast)** Stephania Bolden (stephania.bolden@noaa.gov) Phone: 727/824-5312

B. NOS Archive:
i. **Primary Contact**: Julie Carter (julie.carter@noaa.gov) Phone: 843/762-8547

Figure II-5. Instructions: Collecting, Certifying, Identifying and Shipping Tissue Samples Collected from Sturgeon.

Appendix 3b **Summary Sheet for Genetic Tissue Samples** [1,2]

Date	Species	Unique ID.	Genetic Tissue Type	Preservative	Location (River)	Location (River km)	Location (Lat/Long)	Total Length (mm)	Weight (g)	Sex	Comments

1. Please coordinate with NMFS to receive a file copy of this appendix in spreadsheet format.
2. If multiple samples are shipped, attach this form (and disk copy) to supplement Appendix 3a.

Figure II-5. (Continued)

Appendix 3c

NMFS Guidelines for Air-Shipment of "Excepted Quantities" of Ethanol Solutions

These guidelines have been adapted with permission from the University of New Hampshire-Office of Environmental Health & Safety; our appreciation is to Andy Glode for providing reference materials upon which this guide was created.

The U.S. Department of Transportation (DOT: 49 CFR 173.4) and the International Air Transport Association (IATA: 2007 Dangerous Goods Regulations, Sec. 2.7) regulate shipments of ethanol (ETOH) in *excepted quantities*. As a result, specific procedures must be followed as well as certifying proper training of individuals prior to packaging and shipping specimens preserved in ETOH. These guidelines will inform proper shipping and also satisfy certifying requirements. Failure to meet such requirements could result in regulatory fines and/or imprisonment.

Therefore, prior to submitting ETOH preserved samples and appropriate documentation (*e.g.*, a FedEx Airbill) to a carrier, please read, initial and sign this document, affirming you have understood the requirements as outlined. Please include this document in the shipping package and retain a copy for your records.

1) Packages and documents submitted to a carrier must not contain any materials other than those described in this document (*i.e.* containers holding ethanol-preserved specimens and related absorbent and packaging materials). Also, laboratory or sampling equipment, *unrelated documents*, or other goods must be packaged and shipped in separate boxes. (Note: ETOH solutions are not permitted to be transported in checked baggage, carry-on baggage, or airmail.) **I understand (_____)**

2) Please read the manufacturer's Material Safety Data Sheet (MSDS) for ETOH recognizing ETOH (55 - 100%) is classed as hazardous flammable material (NFPA Rating = 3). Note also, its vapor is capable of traveling a considerable distance to an ignition source causing "flashback." Properly packaging and labeling shipments of ethanol solutions will minimize the chance of leakage, and would also communicate the potential hazard to transport workers in the event of a leak. **I understand (_____)**

a) **Quantity Limits**: Small quantities (inner container less than 30 ml, with a maximum net quantity of 500 ml for the entire package) of ETOH can be shipped with "Excepted Quantities" labels without completion of a Dangerous Goods Declaration. (e.g., If shipping vials having a maximum volume of 10 ml each, you may put up to 50 vials in one box.) **I understand (_____)**

b) **Package Components**:

i. ***Inner (primary) packaging (e.g., vial, tube, jar, etc.)***: Do not completely fill inner packaging; allow 10% head-space for liquid expansion. Liquids must not completely fill inner packaging at a temperature of 55°C (130°F). Closures of inner packaging (e.g., vials with tops) must be held securely in place with tape or other positive means. **I understand (_____)**

ii. ***Intermediate (secondary) packaging (e.g. Ziplock or other plastic bag)***: Place inner container(s) (e.g., vials with ETOH) into a high-quality plastic bag. Then add an absorbent material capable of absorbing any spillage without reacting with the ethanol. Seal the first bag tightly and then tape the locking seals. Next, seal the inner bag within a second bag for added safety. **I understand (_____)**

iii. ***Outer packaging (e.g., cardboard box)***: Ethanol solutions may not be shipped in envelopes, Tyvek® sleaves, or other non-rigid mailers. The dimensions of the outer box must be at least 100 mm (~4 inches) on two sides. Any space between the inner packing containers placed in the outer packaging should be eliminated with additional filler. **I understand (_____)**

c) **Package Labels**:

i. ***Dangerous Goods in Excepted Quantities Label*** **(Figure 1.)**: The label must display a "3" as the ethanol hazard class number using a black marker. You may obtain self-adhesive labels from NMFS, or else, order online. **I understand (_____)**

ii. ***Name and Address:*** The outer container must display the name and address of the shipper and consignee. When re-using shipping boxes, completely remove or black out all unnecessary labels or marks. **I understand (_____)**

Figure 1. Dangerous Goods in Excepted Quantities label

Figure II-5. (Continued)

Appendix 3c (continued)

d) **Package Tests:**

A representative example of packaging used for excepted quantities of ethanol solutions must pass a drop test and compressive load test without any breakage or leakage of any inner packaging and without any significant reduction in package effectiveness. Perform the following tests on a representative example of your packaging and keep a record of the results.

i. ***Drop Test***: Drop a representative package from a height of 1.8 m (5.9 feet) directly onto a solid unyielding surface:

		Test Results
a.	One drop flat on the base;	(_____)
b.	One drop flat on top;	(_____)
c.	One drop flat on the longest side;	(_____)
d.	One drop flat on the shortest side; and	(_____)
e.	One drop on a corner.	(_____)

ii. ***Compressive Load Test***: Apply a force to the top surface of a representative package for a duration of 24 hours, equivalent to the total weight of identical packages if stacked to a height of 3 meters. (_____)

e) **Package Documentation:**

Proper documentation is required for all shipments of hazardous materials. Incorrect documentation is the most common cause for package refusal. If using documentation for couriers other than FedEx, UPS and DHL, please contact NMFS for assistance.

i. ***FedEx***: For domestic shipments with FedEx Express, fill out the standard US Airbill. Fill out the form completely including the following information:

a. In Section 6, Special Handling, check the box "Yes, Shipper's Declaration not required."
b. On the top of the form above the FedEx tracking number, include the statement, "***Dangerous Goods in Excepted Quantities***" See example in **Figure 2.** **I understand (_____)**

ii. ***DHL***: The "*Nature and Quantity of Goods*" box of the air waybill must include "**Dangerous Goods in Excepted Quantities.**" **I understand (_____)**

Figure 2. Example of FedEx Airbill

By signing this document, I affirm I understand the hazards associated with ethanol and the shipping requirements for ethanol solutions, as outlined in this guide. I also understand I am required to include a copy of this document in the package and that it should be appended to an ESA permit (if listed samples are shipped).

Print Name:		Signature:	
Employer:		Employer Address:	
Date:			Phone:

Figure II-5. (Continued)

Appendix 3a:

Certification, Identification and Chain of Custody Form for Submitting Sturgeon Genetic Tissue Samples.[1],[2]

(A) CERTIFICATION OF SPECIES (Collector)

I, _____, hereby certify that I have positively identified the
Full Name
fish or fishes sampled in this shipment as: ☐ shortnose sturgeon; ☐ Atlantic sturgeon; ☐ other ☐ unknown
based on my knowledge and experience as a _____.
Position Job Title

Signature: _____ Date Identified: _____
Address: _____
_____
Phone Number: _____

(B) SAMPLE IDENTIFICATION

Species Identification: ☐ shortnose sturgeon; ☐ Atlantic sturgeon; ☐ unknown
Unique ID No: _____; Tissue Type: _____; Preservative: _____;
Location: (River: _____; River-km: _____; Lat/Long: _____;
River Location Description: _____);
Total Length (TL) of Specimen (mm): _____ Weight of Specimen (g): _____; Sex (if known) _____

Specific comments on take: _____
_____

☐ Check here if multiple samples are submitted and use *Field Collection Report* (Appendix 3b) with the data fields listed in this section.

(C) EVIDENCE OF CHAIN OF CUSTODY

1.	Release Signature	NMFS Permit No.	Method of Transfer	Date
	Receipt Signature	NMFS Permit No.		Date
2.	Release Signature	NMFS Permit No.	Method of Transfer	Date
	Receipt Signature	NMFS Permit No.		Date
3.	Release Signature	NMFS Permit No.	Method of Transfer	Date
	Receipt Signature	NMFS Permit No.		Date

[1] Instructions on next page.
[2] If multiple samples are shipped, attach summary sheet in Appendix 3b.

Figure II-6. Certification Species Identification of Standard

5.0 FIELD DATA SHEET CODING INSTRUCTIONS

5.1 The field data sheet consists of five card types incorporated onto the front and back of an 8-1/2" x 11" sheet of weatherproof paper (Figure II-7). Data from sample processing that occurs in the field for all field tasks is recorded on a data sheet of this type. Specific coding instructions for each of the five card types included on this data sheet appear on the following pages. Data requirements are task specific (i.e., entries are not made for all variables for every task) and are outlined below. Data sheets are made task-specific by blocking out the box(es) from those variables not required for that task.

The following card types are used for the Striped Bass Program.

CARD TYPE	DESCRIPTION
S1	Field Header Information
Q1	Water Quality Data
R1	Number of samples taken to laboratory
C1	Counts of species by length class and used for bird predation tally starting in 2004-05
M2	Tag number, fish identification, length, tag type and condition for all striped bass; clip type, enumeration by length group, release status, and condition for all Atlantic tomcod

All limiting values, tolerances, and precision limits are described or referenced in the preceding sections. All codes and variables are described in detail in the Con Edison Data Dictionary. The term "enter" appears in the data sheet coding instructions for all variables which require review of the data dictionary for appropriate codes. The term "record" indicates no further information is required to complete the coding. The abbreviation N/A means the variable is not applicable to this study and is not entered or recorded.

5.2 CODING INSTRUCTIONS

Coding instructions for each card type are given below. Definitions for each variable and corresponding codes for each variable can be found in the Con Edison Data Dictionary. All entries should be made neatly with only one symbol per data block. The individual whose initials are entered on the data sheet is responsible for assuring the legibility of all entries.

5.2.1 Coding for Header Information

VARIABLE NAME	INSTRUCTIONS
TASK_CD	preprinted 53
SAMPLE	preprinted
GEAR	49 = 9 m trawl
YEAR	11 or 12

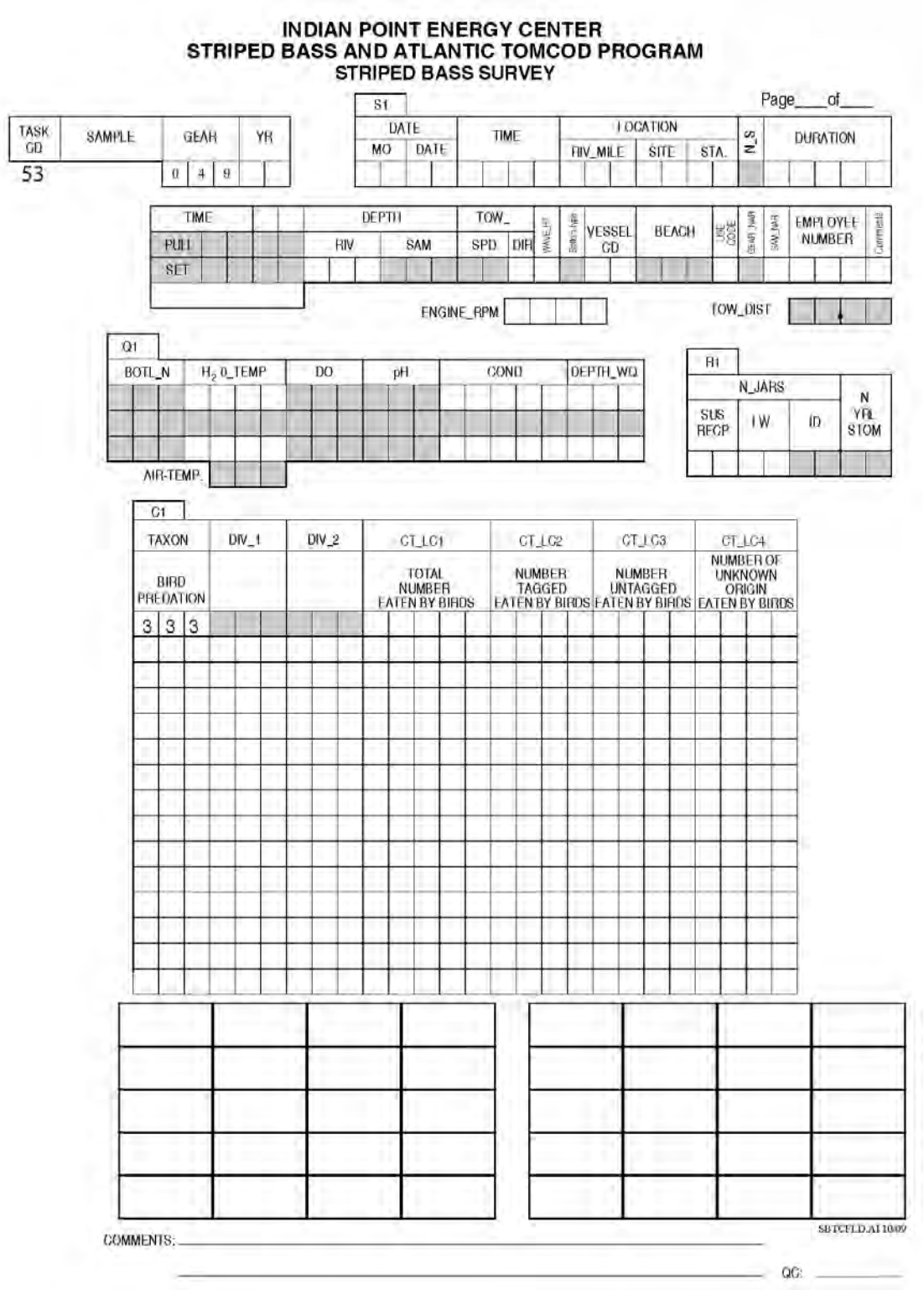


Figure II-7. Field data sheet for the Hudson River Striped Bass and Atlantic Tomcod Programs (Page 1 of 2)

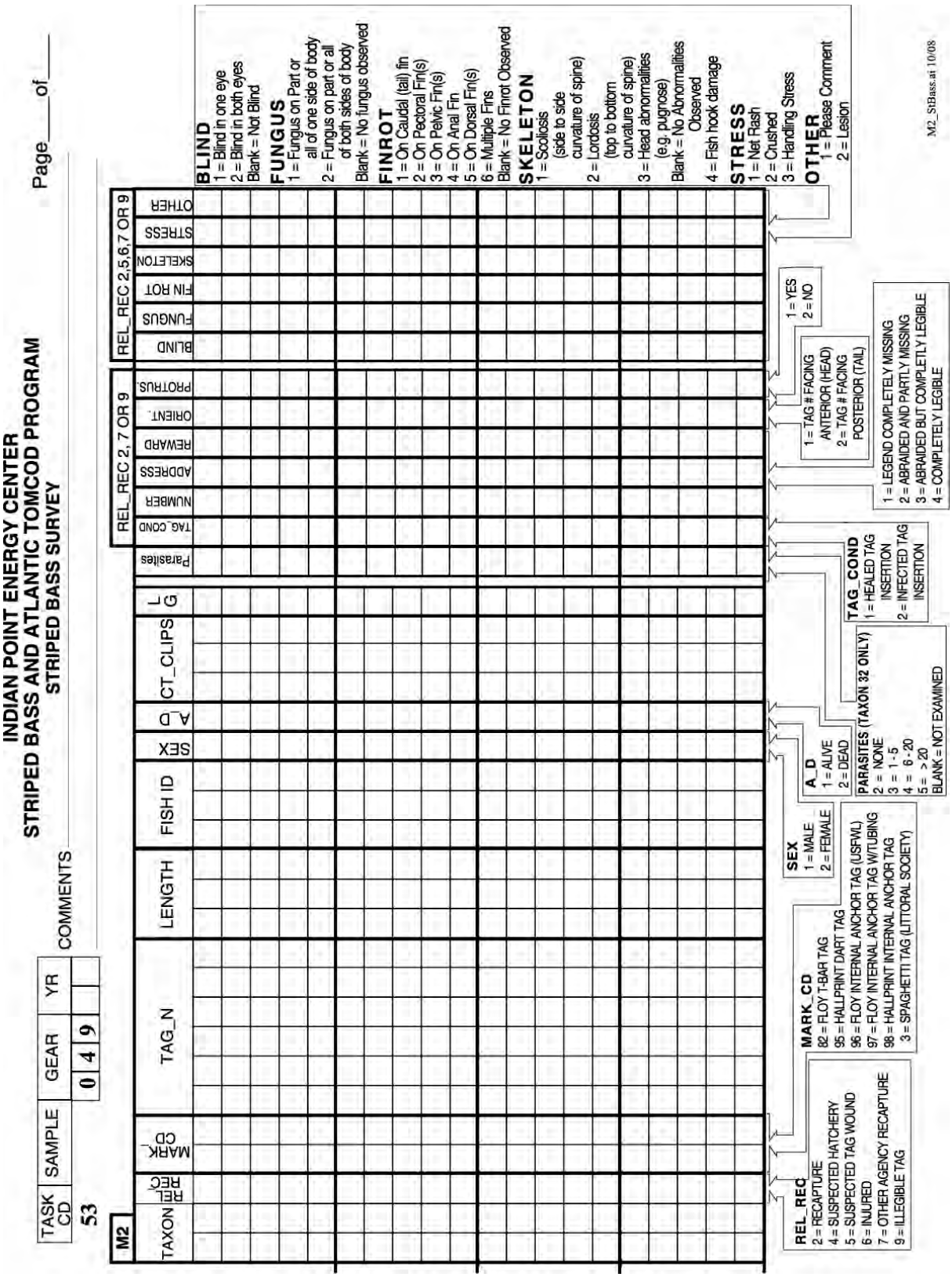


Figure (II-7). (Page 2 of 2)

5.2.2 Source Card Type S1

Source card type S1 is used to record field sampling information.

NOTE: N/A = not applicable, therefore not recorded.

VARIABLE NAME	INSTRUCTIONS
SOURCE CARD TYPE	Preprinted S1
DATE	Record date (Mo/Day) of sample collection
TIME	Record time of the collection using 24-hour clock
LOCATION:	
RIV_MILE	Record river mile in which sample was collected
SITE	Enter appropriate code for site of collection: 4 = west of channel (≤20 ft.) 5 = channel >20 ft. 6 = east of channel (≤20 ft.)
STATION	Enter appropriate code for station: 4 = Upper Harbor 11 = Battery region of the Hudson River 12 = Yonkers region of the Hudson River 13 = Tappan Zee region of the Hudson River 14 = Croton-Haverstraw region of the Hudson River
N_S	N/A
DURATION	Record the duration of the fishing effort in minutes
DEPTH_SAM	N/A
DEPTH_RIV	Record river depth in feet
TOW_SPD	N/A
TOW_DIR	Enter tow direction code: 1 = north 2 = south 3 = east 4 = west
WAVE_HT	Enter code for estimated wave height: 1 = calm to 1/2 ft 2 = light chop (>1/2 ft to 1 ft) 3 = heavy chop (>1 ft to 2 ft) 4 = large waves (>2 ft)
BOTM_TYP	N/A

VARIABLE NAME	INSTRUCTIONS
VESL_CD	Enter 15 for the Pannaway
BEACH	N/A
USE_CODE	Enter appropriate use code: 1 = Assigned to samples when there are no sampling problems. 2 = Assigned to samples when sampling problems are encountered but markable Atlantic tomcod, unusual species or species requiring special handling (Atlantic and shortnose sturgeon) are caught. All fish are processed as USE_CODE=1 samples. 5 = Assigned to samples when sampling problem are encountered and no markable Atlantic tomcod, unusual species, any species requiring special marking are caught (i.e., Void).
GEAR_NAR	N/A
SAM_NAR	Enter code explaining catch: Blank = not a tomcod laboratory sample 1 = tomcod laboratory sample
INITIALS	Record employee number of individual responsible for sample collection
COMMENTS	Record any pertinent information not recorded elsewhere on back of sheet. Check comments block if comments may affect data interpretation
ENG_RPM	Record revolutions per minute (RPM) of sampling vessel engine during collection of towed net sample
TOW_DIST	N/A

5.2.3 Source Card Type Q1

Source card type Q1 is used to record water quality data.

NOTE: N/A = not applicable to present task, therefore not recorded.

VARIABLE NAME	INSTRUCTIONS
SOURCE CARD TYPE	Preprinted Q1
BOTL_NO	Record water quality sample bottle number (if used)
H_2O_TEMP	Record water temperature to the nearest 0.1°C
D_O	N/A
pH	N/A

COND	Record conductivity to the nearest scale unit in microseimens per centimeter (µS/cm)
DEPTH_WQ	Record depth (in feet) at which the water quality sample was taken. Water quality readings should be taken 1 foot below the surface and 1 foot above bottom

5.2.4 Source Card Type R1

Source card type R1 is used to record the type and number of jars which contain biological sample(s).

NOTE: N/A = not applicable to present task, therefore not recorded.

VARIABLE NAME	INSTRUCTIONS
SOURCE CARD TYPE	Preprinted R1
NO. OF JARS	N/A
SUS_RECAP	Record number of jars containing fish which are suspected hatchery recaptures- N/A after 1997-98
LW	N/A
ID	Record number of jars containing fish for identification and enumeration
YRL STOM	N/A

5.2.5 Source Card Type C1

Source card type C1 was originally used to record total catch per length class data for Atlantic tomcod (prior to 4 January 1999). Because individual length measurements are taken for each striped bass or Atlantic tomcod caught, length classes and length groups will be assigned during data processing and not in the field. Starting in November of 2008 the C1 card type will also be used to record total catch per length class for each fish species caught in addition to sturgeon, striped bass and Atlantic tomcod. Therefore, the C1 card type will be used in the field to record information about bird predation on striped bass (refer to Section 2.7.3 for Taxon 333) in the first record of the C1 card type, and then the total catch for each of the other fish taxa will be recorded by length class, in the records below the Taxon 333 record. Refer to the ConEd data dictionary to determine the correct taxon for each fish species in the by-catch.

N/A= not applicable to present task, therefore not recorded.

VARIABLE NAME	INSTRUCTIONS
SOURCE CARD TYPE	Preprinted C1
TAXON	Enter taxon= 333 for data for bird predation on released striped bass or enter the taxon code for each species in the by-catch.

VARIABLE NAME	INSTRUCTIONS
DIV_1	N/A (will be computer coded)
DIV_2	N/A (will be computer coded)
CT_LC1	Record the total number of striped bass eaten by birds or the total number of each by-catch taxon in length class 1.
CT_LC2	Record the total number of tagged striped bass eaten by birds or the total number of each by-catch taxon in length class 2.
CT_LC3	Record the total number of untagged striped bass eaten by birds or the total number of each by-catch taxon in length class 3.
CT_LC4	Record the total number of striped bass of unknown origin eaten by birds or the total number of each by-catch taxon in length class 4.
COMMENTS	Record any pertinent information not recorded elsewhere (only check box if comments may affect data interpretation).

5.2.6 Source Card Type M2

Source card type M2 is used to record mark/recapture and length/weight data for fish processed in the field.

NOTE: N/A = not applicable to present task, therefore not recorded.

VARIABLE NAME	INSTRUCTIONS
COMMENTS	Record any pertinent information not recorded elsewhere (only check if comments may affect data interpretation)
SOURCE CARD TYPE	Preprinted M2
TAXON	Enter 30 for striped bass or 32 for Atlantic tomcod
REL_REC	Enter appropriate release/recapture code: 1 = Release 2 = HRF Tag Recapture 3 = Atlantic tomcod lab fish (Note: SAM_NAR must equal 1) 4 = Suspected hatchery recapture 5 = Tag wound-striped bass or Atlantic tomcod recapture from prior program, take fish to lab for examination 6 = Other (fish injured and is tagged or released alive without tagging, or Atlantic tomcod given to NYU) 7 = Fish recaptured with tag other than HRF internal anchor tag or dart tag 9 = Striped bass with illegible HRF tag legend
MARK_CD	Enter the mark code for the type of tag or finclip: 82 = Floy T-bar tag used during 1984 program (dorsal insertion)

VARIABLE NAME	INSTRUCTIONS
	90 = Visual implant tag in Atlantic tomcod (orange). 91 = Visual implant tag in Atlantic tomcod (yellow). 95 = Hallprint dart tag (dorsal insertion) 96 = Floy internal anchor tag (HRF prior to 1988, current USFWLS) 97 = Floy internal anchor tag with tubing (pink, HRF before 1988) 98 = Hallprint internal anchor tag (HRF used since 1987) 3 = Spaghetti tag (Littoral Society, dorsal insertion)
TAG_N	Record appropriate tag number
LENGTH	Record maximum total length of each striped bass and Atlantic tomcod measured to the nearest millimeter
FISH_ID	Record fish identification number (1-999) assigned sequentially for each sample to each striped bass tagged and released. Record FISH_ID for each recaptured Atlantic tomcod.
SEX	Enter code for sex of fish if externally apparent: 1 = male 2 = female
A_D	Enter appropriate alive/dead code for fish at time of capture: 1 = Alive at time of capture and judged capable of surviving marking or tagging and release. 2 = Dead at time of capture or judged incapable of surviving marking or tagging and release.
CT_CLIPS	N/A
	N/A
PARASITES	For Atlantic tomcod enter the appropriate code describing the degree of external parasitic infestation 2 = no parasites observed 3 = light, 1 to 5 external parasites 4 = moderate, 6 to 20 external parasites 5 = heavy, >20 external parasites blank = not examined
TAG_COND	Enter the code for the condition of the striped bass tag insertion site for REL_REC = 2, 7 or 9 striped bass: 1 = Healed tag insertion 2 = Infected tag insertion

VARIABLE NAME	INSTRUCTIONS
NUMBER	Enter the code for the legibility of the legend on ADDRESS the external streamer of REL_REC = 2, 7 or 9 REWARD striped bass: 1 = legend completely missing 2 = legend abraded and partly missing 3 = legend abraded but completely legible 4 = legend completely legible
ORIENTATION	Enter the code for the orientation of the tag number on the external streamer of REL_REC = 2, 7, or 9 striped bass: 1 = tag number facing anterior (head) 2 = tag number facing posterior (tail)
PROTRUSION	Enter the code for the presence or absence of tag anchor protrusion for REL_REC = 2, 7 or 9 striped bass: 1 = yes 2 = no
BLIND	Enter the code for the condition of each REL_REC = 2, 5, 6, 7, or 9 striped bass with respect to blindness: 1 = blind in one eye 2 = blind in both eyes blank = not present
FUNGUS	Enter the code for the condition of each REL_REC = 2, 5, 6, 7, or 9 striped bass with respect to body fungus (lymphocystis): 1 = fungus on part or all of one side of body 2 = fungus on part or all of both sides of body blank = not present
FINROT	Enter the code for the condition of each REL_REC = 2, 5, 6, 7, or 9 striped bass with respect to fin rot: 1 = fin rot on caudal (tail) fin 2 = fin rot on pectoral fin(s) 3 = fin rot on pelvic fin(s) 4 = fin rot on anal fin 5 = fin rot on dorsal fin(s) 6 = fin rot on multiple fins blank = not present
SKELETON	Enter the code for the condition of each REL_REC = 2, 5, 6, 7, or 9 striped bass with respect to skeletal abnormalities:

VARIABLE NAME	INSTRUCTIONS
	1 = scoliosis (side to side curvature of spine) 2 = lordosis (top to bottom curvature of spine) 3 = head abnormalities (e.g. pugnose) 4 = fish hook damage to mouth or gills (pin hooked) blank = none present
STRESS	Enter the code for the condition of each REL_REC = 2, 5, 6, 7, or 9 striped bass with respect to stress: 1 = net rash 2 = crushed or cut 3 = handling stress blank = none present
OTHER	Enter the code for the condition of each REL_REC = 2, 5, 6, 7, or 9 striped bass with respect to other observed factors relating to poor condition that are not already coded: 1 = if other injury is present, describe injury in COMMENTS 2 = lesion or tumor present on body

5.2.7 Source Card Type M1

Source card type M1 (Figure II-8) is used to record information associated with each shortnose surgeon or Atlantic sturgeon caught.

VARIABLE NAME	INSTRUCTIONS
TASK CODE:	Preprinted 53 = striped bass trawl program
SAMPLE:	Record sample number.
GEAR:	Preprinted 49 = 9 m trawl
DATE:	Record date (Mo/Day) of sample collection.
YEAR:	Record year.
RIVER MILE:	Record river mile of collection.
SITE:	Enter the site of collection: 4 = west of channel (<20 ft deep) 5 = channel (> 20 ft deep) 6 = east of channel (≤20 ft deep).
STATION	Enter the appropriate code for station: 4 = Upper Harbor 11 = Battery (river miles 0-11) 12 = Yonkers (river miles 12-23) 13 = Tappan Zee (river miles 24-33) 14 = Croton-Haverstraw (river miles 34-38)

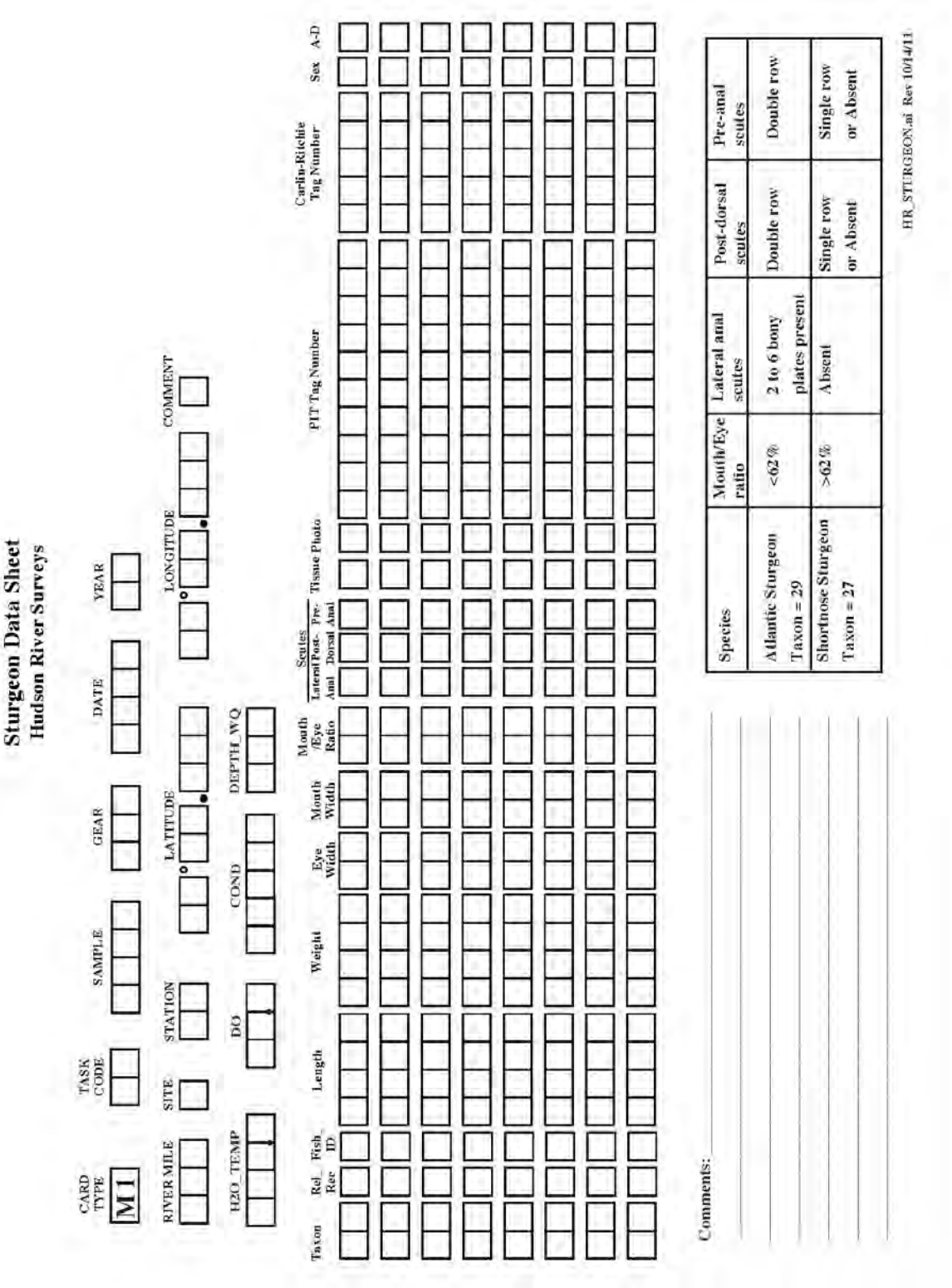


Figure II-8. Sturgeon Data Sheet for Striped Bass/Atlantic Tomcod Program

VARIABLE NAME	INSTRUCTIONS
TAXON:	Enter 27 = shortnose sturgeon 29 = Atlantic sturgeon.
REL_REC:	Record 1 = Release 2 = Recapture 3 = Dead fish returned to laboratory.
FISH_ID:	Record a fish identification number (1-999) unique to each fish and assigned sequentially to each sturgeon caught.
LENGTH:	Record the total length of each sturgeon caught in mm.
WEIGHT:	Record the wet weight in grams of each sturgeon caught.
EYE WIDTH:	Measure and record the distance between the eyes to the nearest mm for each sturgeon caught.
MOUTH WIDTH:	Measure and record the distance inside the mouth between the lips to the nearest mm for each sturgeon caught.
MOUTH/EYE RATIO:	Record the mouth width divided by the eye width to the nearest whole percentage (e.g. 45% or 73%).
LATERAL ANAL SCUTES:	Enter a code for the presence or absence of scutes (bony plates at least as large as the pupil of the eye) found between the base of the anal fin and the midlateral row of scutes. 1 = no scutes found just above base of the anal fin 2 = two to six scutes found just above the base of the anal fin
POST-DORSAL SCUTES:	Enter a code for the presence or absence of scutes (bony plates at least as large as the pupil of the eye) found along the dorsal surface between the base of the dorsal fin and the caudal (tail) fin. 1 = one row of scutes found along the dorsal mid-line, or absent 2 = two rows of scutes, one on either side of the dorsal mid-line.
PRE-ANAL SCUTES:	Enter a code for the presence or absence of scutes (bony plates at least as large as the pupil of the eye) found along the ventral surface between the base of the anal fin and the pectoral fins. 1 = one row of scutes found along the ventral mid-line 2 = two rows of scutes, one on either side of the ventral mid-line.
TISSUE:	Enter a code specifying if a tissue sample was taken from the sturgeon caught (see Section 4.3 of this SOP for details). Blank = no tissue sample taken 1 = tissue sample taken

VARIABLE NAME	INSTRUCTIONS
PHOTO:	Enter a code specifying if one or more digital photographs were taken of the sturgeon caught (see Section 4.2 of this SOP for details). Blank = no photos taken 1 = photos taken
PIT TAG NUMBER:	Record 10 digit Pit Tag number if present.
CARLIN-RITCHIE TAG:	Record 5 digit Carlin Ritchie tag number if present.
SEX:	1 = male 2 = female 3 = not examined 4 = examined but unable to determine
A-D:	1=alive 2=dead

6.0 QUALITY CONTROL FOR FIELD MARK/RECAPTURE DATA

Quality control (QC) inspections are conducted to insure that fewer than one quality control sample in ten has a data recording error. A QC sample is defined as a record (line) of data recorded on the M2 card type of the field data sheet (Figure II-7).

6.1 A CSP-V continuous sampling plan is used to provide an AOQL of at least a 10% (6.5%) or better error rate for field coding of tag and length data, with the parameters of the plan defined as follows:

i = 12 records

f = 1/10 records

x = 4 records

A record is an entire line of data associated with a particular fish on the M2 card type, including the following variables:

TAXON, REL_REC, MARK_CD, TAG_N, LENGTH, WEIGHT (if condition factor fish), FISH_ID, SEX, TAG_COND, A_D, CT_CLIPS and LG

Person who measures and tags fish = tagger

Person who reads tag and writes data = data person

Tagger and data person represent a team

6.1.1 For each unique team of tagger and data person, the QC plan begins with 100% of the records being inspected and rerecorded by an independent party (Crew Leader).

6.1.2 After 12 records in a row are found to be without error (all data are accurate and length is within 3% agreement), the crew leader inspects the data record for one of every 10 fish. This 1/10 inspection rate carries over from data sheet to data sheet for a given tagging team.

6.1.3 Inspection continues at a frequency of 1/10 and a count is kept of the number inspected in this "skip mode." If an error is detected before 12 records have been inspected in the skip mode, the QC plan is restarted at the beginning with 100% inspection (6.1.1).

6.1.4 If 12 records are inspected in the skip mode without finding an error, inspection continues at the 1/10 inspection frequency until an error is detected. When this defective data record is encountered, the next four records are inspected.

6.1.5 If any of these four records contains an error, the QC plan is restarted at the beginning with 100% inspection (6.1.1).

6.1.6 If no errors are encountered in these four records, inspection resumes at a frequency of 1/10 and a count is kept of the number of records inspected. If a second defective record is found before the next 12 records have been inspected, the QC plan is restarted at the beginning with 100% inspection (6.1.1).

6.1.7 If a second defective record does not occur until after the next 12 records have been inspected at a 1/10 frequency, proceed as in 6.1.4.

6.1.8 The Crew Leader documents the QC results in the left margin of the data sheet next to each record that was QC inspected.

6.2 If errors were observed, the error type and mistaken value are written in the right margin next to the appropriate record. The corrected value(s) are placed in the appropriate columns on the data sheet and replace the mistake(s). Provide notes in the Comments section of the data sheet explaining errors found and their correction.

Error Type:	T	=	Tag
	L	=	Length
	W	=	Weight
	S	=	Taxon (species)
	R	=	REL_REC
	F	=	Fish ID
	S	=	Sex
	C	=	Tag condition
	A	=	A_D
	N	=	CT_Clips
	G	=	Length group
	M	=	Comments

6.3 If members of the team change (either tagger or data man or both) you must start at inspection frequency i=12.

6.4 Tomcod data records are included in this QC plan.

6.5 See attached flow chart (Figure II-9) for a summary of inspection procedures.

6.6 All shortnose and Atlantic sturgeon identification, data records, and labels are subjected to 100% reinspection by a qualified crew member or leader.

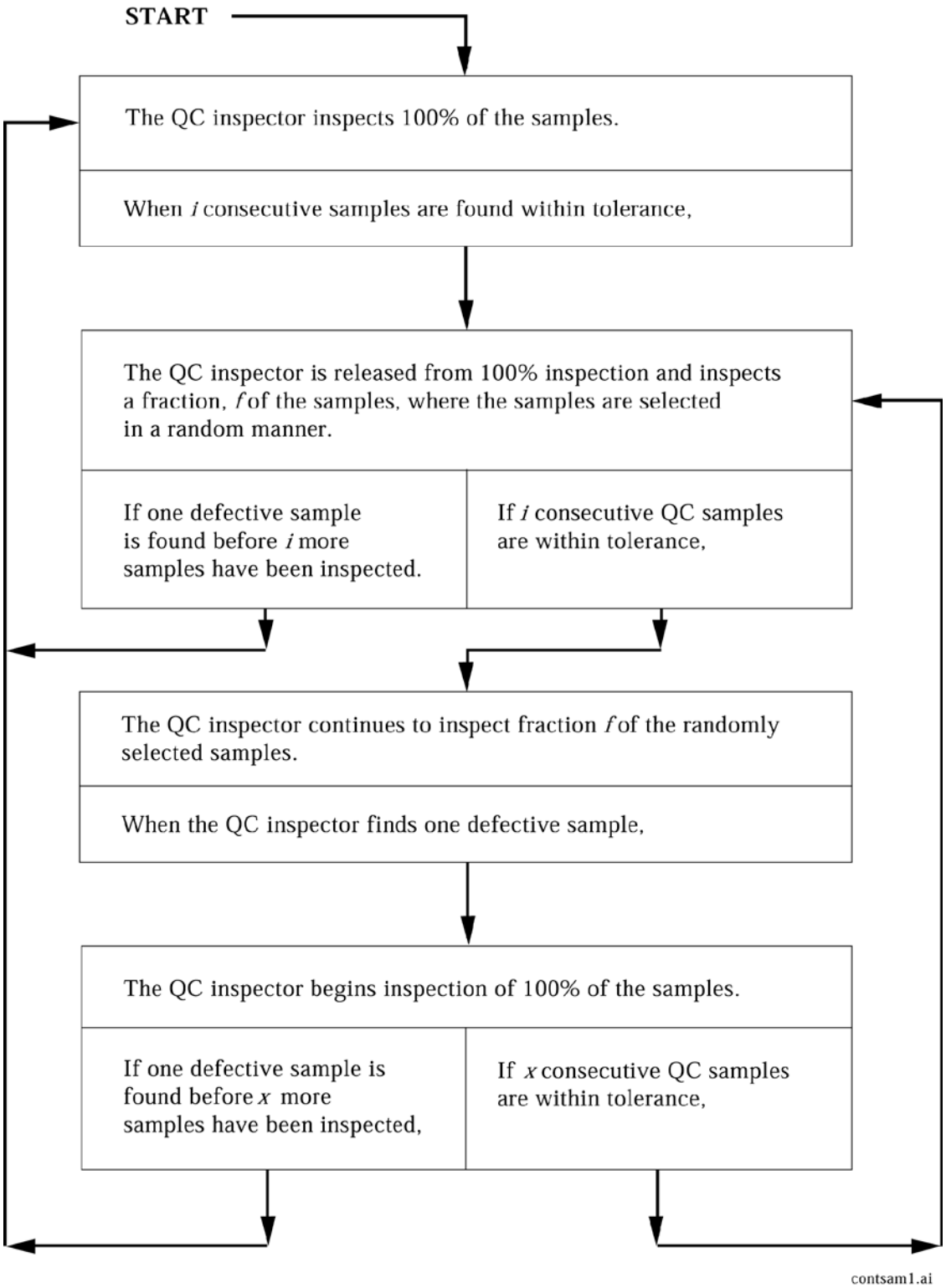


Figure II-9. Procedure for continuous sampling plan (CSP-V) quality control inspection

SECTION III. FIELD STANDARD OPERATING PROCEDURES FOR ATLANTIC TOMCOD BOX TRAP SAMPLES

1.0 OBJECTIVE

1.1 To estimate the size of the Atlantic tomcod spawning population in the Hudson River during the winter of 2011–2012 and make comparisons with previous years' estimates. Box trapping will occur for 13 consecutive weeks from Monday, 5 December 2011 through Friday, 2 March 2012.

1.2 To provide data on major aspects of Atlantic tomcod life history and population dynamics.

1.3 To mark and release Atlantic tomcod caught in box traps with visual implant tags. The recapture of individually tagged fish will provide specific data on movement, growth, and other major aspects of Atlantic tomcod life history and population dynamics.

2.0 GEAR

2.1

Box Trap	Gear Code 36
Frame	3x3x6 ft. (0.9 x 0.9 x 1.8 m)
Number of wings	None
Number of leads	None
Number of fykes	2
Fyke opening	4 x 4 in. (10.2 x 10.2 cm)
Body mesh	0.375 in. (0.9 cm)

3.0 FIELD PROCEDURES

3.1 SAMPLE SITE LOCATION

3.1.1 Box trap sampling is conducted at eighteen (18) fixed sampling sites in the Hudson River between RM 25 and RM 76 (Table III-1). These sites are chosen on the basis of accessibility, river depth, and proximity to the river channel. Box traps may be moved from site to site or to new sites created to maximize catch. All locations (river miles, site) not described in Table III-1 will be described in the comments on the first data sheet and a new "STATION" will be assigned. Box trap locations are coded using a Normandeau field station number, ranging from Normandeau Field Station 5 at the northern end of the sampling area to Normandeau Field Station 21 at the southern end. Box trap sites are not specified by the field crews but are computer generated using a two digit number. The first and second digits are assigned as follows:

Table III-1. Tomcod Box Trap Mark/Recapture Zones, Hudson River Mile (RM), SITE and STATION Designations for the Atlantic Tomcod Box Trap Program

Mark/Recapture Zone (RM)	Box Trap Location	Location (RM–Site)	Latitude	Longitude	Field Station	Station[1]
North						
Cornwall–Hyde Park RM 56–85)	Norrie Point[10]	RM 84-61	N41°50.031	W73°56.332	84	201
	H.R.S.H. Dock[11]	RM 77-61	N41°44.060	W73°56.130	77	202
	Star Oil Terminal	RM 76-41	N41°42.921	W73°56.900	5	203
	Mariner's Harbor	RM 76-41	N41°42.864	N73°36.912	76	310
	Milton – Shell Oil Dock	RM 71-41	N41°39.161	W73°57.205	6	204
	Marlboro Yacht Club (North Corner)	RM 68-41	N41°36.397	W73°57.205	68	309
	Marlboro Yacht Club	RM 68-41	N41°36.383	W73°57.657	7	205
	Cornwall Yacht Club	RM 56-41	N41°26.573	W73°59.833	8	207
	Cornwall Yacht Club-Fuel Dock	RM 56-41	N41°26.596	W73°59.923	56	308
West Point (RM 47–55)	West Point – North Dock	RM 52-41	N41°23.860	W73°57.363	9	208
	West Point – North Dock – South	RM 52-42	N41°23.854	W73°57.386	52	305
	West Point – South Dock	RM 51-41	N41°23.158	W73°57.306	10	209
	[9] West Point – Supplemental	RM 52-43	N41°23.851	W73°57.398	53	311
	[2] Garrison – North	RM 51-61	N41°23.053	W73°56.897	11	210
	[2] Garrison – South	RM 51-62	N41°23.020	W73°56.906	12	211
	[3] Garrison Yacht Club – North	RM 51-63	N41°22.896	W73°56.891	50	303
	[3] Garrison Yacht Club – South	RM 51-64	N41°22.900	W73°56.900	51	304
South						
Indian Point (RM 39–46)	Peekskill Yacht Club	RM 43-61	N41°16.936	W73°56.260	13	213
	[4] Indian Point Hatchery	RM 41-61	N41°15.628	W73°57.944	14	215
	[5] Verplanck – King's Marina	RM 41-62	N41°15.340	W73°57.960	41	302
Yonkers, Tappan Zee, Croton–Haverstraw (RM 12–38)	Croton Yacht Club – North	RM 36-61	N41°12.321	W73°53.634	15	216
	Croton Yacht Club – South [6]	RM 36-62	N41°12.303	W73°53.609	36	301
	Nyack – Petersen Marina	RM 29-41	N41°06.051	W73°54.831	16	217
	Tarrytown					
	Irvington – North	RM 27-61	N41°04.462	W73°53.140	17	218
	Irvington – South	RM 25-61	N41°02.458	W73°52.469	18	219
	[7] Irvington – Middle	RM 25-62	N41°02.422	W73°52.471	19	220
	Irvington-North Corner	RM 25-63	N41°02.444	W73°52.469	25	300
	Irvington-(Between North Corner And station 19)	RM 25-63			26	306
		RM 25-63			27	307
	[8] Pheleps Dodge – North	RM 19-61	N40°56.895	W73°54.065	20	222
	[8] Pheleps Dodge – South	RM 18-61	N40°56.844	W73°54.106	21	223

[1] Station Code in Con Edison Data Dictionary
[2] Access denied by new owner; trap Stations 210 and 211 not fished since 1 December 1998.
[3] Replacement sites for Stations 210 and 211; fished beginning 1 December 1998.
[4] Station 215 filled with silt and too shallow for trap deployment; not fished beginning 1 December 1999.
[5] Replacement site for Station 215; fished beginning 1 December 1999.
[6] Supplemental trap fished here beginning 1 December 1999.
[7] Supplemental trap fished here beginning 1 December 1999.
[8] Access denied by new owner; trap Stations 222 and 223 not fished beginning 1 December 1999.
[9] Supplemental trap fished here beginning in 2005-06 program.
[10] Supplemental trap fished here beginning in January 2007 program
[11] Supplemental trap fished here beginning in January 2007 program

First Digit

- Box traps located on the west bank of the river are assigned a site of "4"
- Box traps located on the east bank of the river are assigned a site of "6"

Second Digit

- If a trap is the only one located on that side of the river within a river mile, it is assigned a "1"
- When two traps are located on the same side of the river within a river mile, the northernmost trap is assigned a "1" and the southernmost trap is assigned a "2"

3.2 GEAR DEPLOYMENT

3.2.1 Box Traps

3.2.1.1 Box traps are lowered into the water (4-40 ft) by a wire cable and attached to a solid structure on a dock, pier, bulkhead, etc.

3.3 USE CODE

3.3.1 For box traps samples are either "use code 1", "2" or "5".

3.3.2 Use code and sample narrative code definitions.

USE CODE AND SAMPLE NARRATIVE CODE DEFINITIONS

USE CODES	DEFINITION
1	Assigned to samples when there are no sampling problems
2	Assigned to samples when sampling problems are encountered but markable Atlantic tomcod, unusual species or species requiring special handling (Atlantic and shortnose sturgeon) are caught. All fish are processed as USE_CODE=1 samples.
5	Assigned to samples when sampling problem are encountered and no markable Atlantic tomcod, unusual species, any species requiring special marking are caught (i.e., Void).

SAMPLE NARRATIVE CODES

Blank	Atlantic tomcod were caught and none were taken to the laboratory.
1	Atlantic tomcod were taken to the laboratory (REL_REC=3 fish)
2	No Atlantic tomcod caught

3 Lab processing problems; sample spilled, deteriorated, misplaced sample not processed

3.4 FIELD PROCESSING OF SAMPLES

3.4.1 "Use Code 1" And "Use Code 2" Box Trap Samples

All markable Atlantic tomcod are handled as outlined in Section III-3.4.4. All other fish except unusual species are released without enumeration. All unusual species are enumerated by length class and released. Species requiring special handling are discussed in Section III-3.4.3.

3.4.2 "Use Code 5" Box Trap Samples

Void samples are not processed. A data sheet should be completed for each USE CODE 5 sample documenting the reasons why the sample was void.

3.4.3 Species Requiring Special Handling

3.4.3.1 See Section II – 4.0 for details on processing Atlantic and shortnose sturgeon.

3.4.3.2 Striped bass collected in box trap samples are ***not*** checked for hatchery-administered (second dorsal fin) finclips or for hatchery administered magnetic cheek tags.

3.4.4 Handling Procedures for Atlantic Tomcod Collected in Box Traps

3.4.4.1 Box traps are checked daily (Monday through Friday). From each box trap, all Atlantic tomcod are inspected for all tags or tag wounds are measured to the nearest mm TL. Subsequent data processing will enumerate tomcod into length class (Table III-2) and into each of 8 length groups (Table III-3).

3.4.4.2 All Atlantic tomcod which may be recaptures from the same year's box trap program based on the tag color or tag number (Section 3.5) are coded as REL_REC=2, released away from the capture site and in the same river mile after the species, mark code, release code, alive dead status length group are recorded on the M2 card type of the field data sheet.

3.4.4.3 All Atlantic tomcod which may be recaptures from previous programs (based on tag color or tag number) are assigned REL_REC=5 on the M2 card and taken to the lab for verification after the species, status, Fish ID and length are recorded on the M2 field card. Fish should be transported in separate bags labeled as to Sample and Fish ID.

3.4.4.4 If a marked fish is recaptured under unusual circumstances, e.g., washed ashore dead, killed by a predator, boat, etc. or given to the crew by a person who doesn't know the origin of the fish, the fish is placed in a sample jar with 10% formalin and the necessary recapture labels should include a description of the circumstances under which the fish was collected.

3.4.4.5 When other contractors recapture Normandeau marked fish and give the information to Normandeau crews in the field, the applicable gear code is used. (See GEAR CODE list in the Con Edison Data Dictionary).

Table III-2. Atlantic Tomcod Length Classes

Length Class	Millimeter Range (Total Length)
1	0-Division I
2	Division I+1-Division II
3	Division II+1-250
4	≥251

	Total Length in Millimeters	
Sampling Date	**Division I**	**Division II**
31 Oct–04 Dec 2011	160	260
05 Dec–11 Dec 2011	200	275
12 Dec–18 Dec 2011	210	275
19 Dec–31 Dec 2011	225	290
01 Jan 2012–07 April 2012	20	225
08 April 2012–21 April 2012	50	225

NOTE: If Division II is >250 then LC3 does not exist and LC4 becomes Division II. Therefore, LC3 does not exist before 01 Jan 2012.

Table III-3. Atlantic Tomcod Length Groups

Length Group	Millimeter Range (Total Length)
1	≤125
2	126-150
3	151-175
4	176-200
5	201-225
6	226-250
7	251-275
8	≥276

3.4.4.6 All tomcod caught in box traps are tagged if they are not suspected recaptures, dead or required for laboratory analysis. From each box trap, all Atlantic tomcod are inspected for tags or tag wounds, and measured.

3.4.4.7 Markable Atlantic tomcod are taken from box trap samples and placed in holding containers.

3.4.4.8 Extremely large catches of markable Atlantic tomcod are handled as expeditiously as possible. If there is not enough time to tag the entire catch without stressing the fish, the crew tags as many fish as possible, and leaves sufficient time to measure each remaining Atlantic tomcod and check the remaining fish for marks. Alternatively, the field crew leader may decide to finclip the remaining fish, or finclip the entire catch if the field crew determines that doing so would substantially reduce handling mortality. If for some reason the remaining fish must be released without counting, these fish are not checked for tags. ***Even if a marked fish is observed among these fish, it should not be selected from the group.***

3.4.4.9 If Atlantic tomcod are marked with a finclip, finclip codes (Table III-4) are used which are specific for weekly or biweekly marking periods. The fin is clipped as close to the body as possible without clipping the flesh of the fish. Please note that the right or left side of the fish is the same as your right or left while viewing the fish from the dorsal surface with the tail nearest to you and the head away from you.

3.4.4.10 For finclipped or tagged Atlantic tomcod, record the mark code (release or recapture), type of clip (clip code) or tag number, and individual length measurement to the nearest mm TL.

3.4.4.11 The tagged fish are then placed in a recovery container; the water is changed as often as is necessary to reduce stress. Fish are released away from the gear but within the same river mile as captured.

3.4.4.12 If some Atlantic tomcod are supplied to universities or other groups for research purposes, these fish will be examined for marks and assigned REL_REC=6 and an alive/dead code based on their condition when they were removed from the box trap (generally A/D = 1 = alive).

3.4.4.13 All Atlantic tomcod examined for visual implant tags will also be inspected for external parasites before they are released.

2= no parasites observed	5= >20 parasites
3= 1-5 parasites	blank= not examined
4= 6-20 parasites	

3.5 VISUAL IMPLANT TAGGING OF ATLANTIC TOMCOD

A new aspect of the Atlantic tomcod program beginning in 1997-1998 was visual implant tagging of the fish caught in box traps. The only other time that Atlantic tomcod were individually tagged was during the period prior to 1980, when individual fish were tagged with Carlin tags. The recapture of tagged tomcod will help provide specific information on the distribution, movement rates, and growth of individual fish. During 2011–2012, all Atlantic tomcod marked and released from the box trap effort will be tagged; finclips will only be used as a backup procedure or if the field crew determines that doing so would substantially reduce handling mortality for a large catch.

Table III-4. Atlantic Tomcod Finclip Codes Specific for Marking Periods and Box Trap Marking Zones.

Inclusive Dates in Marking Period	Mark Zone	Finclip Code	Finclip Description
Weeks 1-2	North	79	Right pectoral and first anal
	South	50	Right pectoral and second anal
Week 3	North	59	Left pectoral and first anal
	South	71	Left pectoral and second anal
Weeks 4	North	80	First anal
	South	84	Left pectoral
Weeks 5	North	38	Second anal
	South	81	Right pectoral
Weeks 6	North	43	First and second anal
	South	14	Left and right pectorals
Weeks 7	North	60	Right pelvic and first anal
	South	56	Right pelvic and second anal
Week 8	North	13	Left pelvic and first anal
	South	55	Left pelvic and second anal
Week 9	North	87	Left pelvic
	South	85	Right pelvic
Weeks 10-11	North	15	Left and right pelvics
	South	11	Right pectoral and right pelvic
Weeks 12-13	North	69	Left pectoral and left pelvic
	South	72	Left pectoral and right pelvic

NOTE:

North = Hudson River Miles 47-77, Stations 203, 204, 205, 207-211 (north of the Bear Mountain Bridge)

South = Hudson River Miles 12-46, Stations 213, 215-220, 222, 223 (south of the Bear Mountain Bridge)

Finclips will only be used as a backup to mark Atlantic tomcod.

3.5.1 A Northwest Marine Technology soft Vialpha fish tag (visual implant tag, MARK_CD=90 or 91) will be applied to individual Atlantic tomcod caught in the box traps. Yellow or orange tags are used in alternating years to facilitate differentiation of within-year and cross-year recaptures. The tags used during the 2011-2012 program will be orange (Mark_CD=90). The tags used during the 2010-2011 program were yellow (Mark_CD=91). The tags used during the 2009-2010 program were orange (MARK_CD=90). The tags used during the 2008-2009 Program were yellow (MARK_CD=91). The tags used during the 2007–2008 Program were orange (MARK_CD=90). The tags used during 2006-2007 were yellow (MARK_CD=91). The tags used during the 2005-2006 Program were orange (MARK_CD=90), the tags applied during 2004-2005 were yellow (MARK_CD=91) and the tags used during 2003-2004 were orange (MARK_CD=90).

3.5.1.1 If the entire catch of a box trap is tagged, it is not necessary to enumerate the number of fish (CT_CLIPS) tagged into each length group. The count for each length group will be generated by computer from the individual length of each fish recorded with each tag number.

3.5.1.2 If only part (or none) of the catch is tagged, it is important to enumerate the entire tomcod catch into length groups and process the catch as specified in Section III-3.4.4 above. The length group information will be the only complete source of length data for these samples.

3.5.2 A single visual implant tag will be inserted under unpigmented skin on the right operculum of the fish. Please note that the right or left side of the fish is the same as your right or left while viewing the fish from the dorsal surface with the tail nearest to you and the head away from you.

3.5.2.1 Each tomcod tagged and released with a visual implant tag will have the following information recorded on the M2 Card Type of the field data sheet: TAXON (= 32), REL_REC (= 1), MARK_CD (=90 or 91), TAG_N, LENGTH (nearest mm total length), FISH_ID (numbered in ascending order sequentially from 1 within each sample), SEX (if observed), A_D (= 1 for released fish).

3.5.2.2 Tomcod awaiting application of a visual implant tag that are not in good condition (indicated by blindness, fungus, finrot, tissue damage or skeletal deformities) or exhibit stress (from tagging or holding) will be released alive and not be tagged. These fish will be coded as REL_REC=6 with a comment recorded to explain why the fish was not tagged.

3.5.3 Visual implant tags are provided on sheets of paper from which they are removed and inserted into each fish with a Northwest Marine Technology tag injector.

3.5.3.1 The visual implant tags are supplied in rows on transparent 8.5 X 11 inch sheets with the unique tag number printed on the sheet beside the each tag. Each sheet has 15 rows of 20 tags for a total of 300 tags per sheet. The tags are attached to the clear sheet with a biocompatable gel. A separate sheet of white plastic covers the tags and protects them until they are used. Individual rows of tags are separated by perforated lines so that one or more strips can be torn from the sheet and used.

3.5.3.2 The white plastic cover is removed from the sheet and the strip of tags is held in the hand with the first tag to be loaded curved over the forefinger. In this position you are looking at the back of the tag and cannot read the tag number on the tag (you can determine the number from the number printed on the sheet).

3.5.3.3 The tag injector is dipped into water or alcohol if not already wet, and the open side of the needle point is turned down, aligned with the long axis of the tag, and slid over the tag until the tag is entirely inside of the needle. The tag is now loaded into the injector and ready for insertion into the fish.

3.5.3.4 The sharp tip of the needle on the injector is used to cut a pathway in the fish tissue just below the skin where the tag will be positioned as the pushrod of the injector holds the tag in place while the needle is withdrawn from the fish.

3.5.3.4.1 The needle of the tag injector is now turned with the open side up so that you will see the tag number on the tag when it is injected into the fish.

3.5.3.4.2 The needle is inserted just under the skin at a location about 5 mm below and slightly posterior to the right eye. The tag injector needle is inserted at this point and pushed under and parallel to the skin surface 8 mm in a posterior direction until the tip of the needle is under an

unpigmented site on the right operculum. Be sure that the needle tip did not exit the subdermal area through a second puncture.

3.5.3.4.3 The needle tip is then withdrawn about 2 mm to make room for the tag, and the palm of the hand is used to advance the pushrod of the injector slightly so that the tag slides out of the needle and fills the opening left by the withdrawn needle.

3.5.3.4.4 The tag is left in place as the needle is withdrawn by the fingers while the pushrod remains steady. Be careful not to force the tag out of the needle with the pushrod, or the tag may become folded and illegible. The tag must be placed in the channel cut in the tissue by the withdrawn needle of the tag injector.

3.5.3.5 Verify that the tag legend can be read through the skin, and then place the tagged fish in the recovery container. The water is changed as often as is necessary to reduce stress. Tagged fish are released away from the box trap site but within the same river mile as they were caught.

3.5.3.6 The tag injector should be kept clean, sterile, and the needle should be kept sharp.

3.5.3.6.1 Store the tag injector in a container of soapy water (dish detergent) between sampling stations to help prevent fish slime from drying and clogging.

3.5.3.6.2 Wash the tag injector after each day by letting in sit overnight in warm, soapy water, and disinfect it in an alcohol bath or in an iodine (Woundex) bath before each day of use.

3.5.3.6.3 Sharpen the needle after each day of use (or more frequently if needed) using a fine hone, such as an Arkansas stone. The point and bottom cutting edges of the tip are the most important, and can be sharpened by moving the needle firmly (without rolling or tilting) with the existing flat surface aligned with the flat surface of the hone.

3.5.4 Retain the tag sheets with the tag numbers, and write the sample number, date and first and last FISH_ID number on each sheet or strip. These sheets will be used for quality control of the tag numbers recorded on the field data sheet for each sample.

3.5.5 All Atlantic tomcod which are recaptured in the box traps with visual implant tags from the same year's box trap program are coded as REL_REC=2 and released away from the capture site and in the same river mile.

3.5.5.1 All Atlantic tomcod must be carefully inspected for the presence of visual implant tags or tag wounds.

3.5.5.2 Recaptured fish with a visual implant tag present will have the following information recorded on the M2 Card Type of the field data sheet for each fish: TAXON (= 32), REL_REC (= 2), MARK_CD (=90 or 91), TAG_N, LENGTH (nearest mm total length), FISH_ID, SEX (if observed), A_D (alive/dead status at the time of recapture), TAG_COND (condition of the tag insertion site = 1 for healed, = 2 for infected), NUMBER (legibility of the tag = 4 for legible, = 1 for not legible), and condition of the fish (i.e. BLIND, FUNGUS, FINROT, STRESS, other).

3.5.5.3 Recaptured fish with an illegible visual implant tag, with a tag wound but no tag found at the insertion site, or with other unusual features of the tag or tag wound will be processed as described in Section III-3.4.4 (above), placed in a sample bag or other container, labeled with TASK_CD,

SAMPLE, FISH_ID, DATE, TIME, STATION, and GEAR, and taken to the laboratory for mark verification.

3.5.6 All Atlantic tomcod that are recaptured in the box traps which have visual implant tags from previous programs are assigned REL_REC=5 on the M2 card and taken to the lab for verification after recording the same information for each fish that is described in Section III-3.5.5.2 (above). Fish should be transported in separate bags labeled with TASK_CD, SAMPLE, FISH_ID, DATE, TIME,STATION, and GEAR.

3.5.7 All tomcod caught in the trawl will be examined for the presence of visual implant tags and external parasites but will ***not*** be tagged unless directed to do so by the program manager.

3.6 STANDARD STATIONS FOR LABORATORY SAMPLES

3.6.1 Box Traps Biocharacteristics Samples

On assigned days during each week of the Atlantic tomcod box trap program, the entire catch, including recaptured fish, from the standard sites listed below (Table III-5) are transported in buckets with water to the lab alive for processing. The catch from each standard trap site is returned to the lab once in each week of sampling. Catches from additional traps may be taken at the request of the lab section leader depending on population density and distribution as indicated by current trap collections. Catches are taken to the lab alive. Laboratory personnel will complete the SA1 card type (Section VII-4.2) sheet for samples from standard sites that are taken to the lab for processing.

Table III-5. Standard Trap Sites.

Region	River Mile	Site	Station	Location
Tappan Zee	25	East	219 or 220	Irvington[1]
Croton-Haverstraw	36	East	216	Croton Yacht Club
Indian Point	41	East	302	King's Marina[1]
West Point	51	East	303 or 304	Garrison Yacht Club[1]
West Point	51	West	208-209	West Point
Cornwall	56	West	207	Cornwall Yacht Club
Poughkeepsie	71	West	204	Milton – Shell Oil Dock[1]

[1] New or alternative station used in 2002-2003 for the first time. If more than one trap is fished at a given location for these new or alternate standard stations, select the laboratory sample from the trap with the largest catch on the day the lab sample is taken from that location.

3.6.1.1 Total catch by length class (Table III-2) and data by length group (Table III-3) for markable Atlantic tomcod and unusual species will be computer generated for the C1 and M2 field card types from the SA1 stock assessment laboratory data sheet (see Section VII-4.2).

3.6.1.2 During December and January, ripe female Atlantic tomcod less than 126 mm TL or greater than 275 mm TL may be selected from any box trap or trawl sample and taken to the lab at the request of the lab supervisor to maximize filling of fecundity quotas (Section VII). Each

supplemental Atlantic tomcod will have an SA1 laboratory data record completed by the laboratory personnel.

3.6.1.3 On days other than those assigned, the traps at standard trap sites will be handled as normal samples (see Section III-3.4.4).

4.0 WATER QUALITY SAMPLE REQUIREMENTS

4.1 GEAR REQUIREMENTS

Conductivity and temperature measurement: YSI Model 85 meter or YSI Professional Plus (*in situ*).

4.2 SAMPLE COLLECTION

4.2.1 Surface and bottom water samples are collected for each biological collection. If over a half hour delay is anticipated, water quality sampling is done prior to fish processing.

4.2.2 Descriptive data for each sample are recorded on the data sheet (card type Q1). All pertinent data are recorded on the field data sheet.

4.2.3 The surface water quality sample may be collected using a 5-gallon bucket, or by lowering the YSI Model 85 probe to 1 foot below the surface. The bottom water quality sample is collected by lowering the SI Model 85 probe to within 1 foot of the bottom.

4.3 SAMPLE MEASUREMENTS

4.3.1 For box traps, surface water temperature and conductivity are measured with the YSI Model 85 or YSI Professional Plus probe submerged in a bucket sample, or lowered to 1 foot below the surface and recorded on the data sheet (card type Q1). Bottom water quality samples are measured by lowering the YSI Model 85 or YSI Professional Plus probe to within 1 foot of the bottom.

4.3.2 Temperature is recorded to the nearest 0.1^{o}C. Conductivity is recorded to the nearest scale unit in microsiemens per centimeter.

5.0 DATA HANDLING - FIELD DATA SHEET

All completed data sheets are reviewed for completeness and legibility by the originator. Data sheets are then transferred to the Field Operations Supervisor for quality control checks.

5.1 FIELD DATA SHEET CODING INSTRUCTIONS

The field data sheet consists of five card types incorporated onto the front and back of an 8-1/2" x 11" sheet of weatherproof paper (Figure III-1). Data from sample processing that occurs in the field for all field tasks is recorded on a data sheet of this type. Specific coding instructions for each of the five card types included on this data sheet appear on the following pages. Data requirements are task specific (i.e., entries are not made for all variables for every task). Data sheets are made task-specific by blocking out the box(es) for those variables not required for that task.

The following card types are used for the Atlantic Tomcod Box Trap Field Program.

CARD TYPE	DESCRIPTION
S1	Field Header Information
Q1	Water Quality Data
R1	Number of sample jars returned to laboratory
C1	Counts of species by length
M2	Count of tomcod by length group; mark codes and tag numbers

All limiting values, tolerances, and precision limits are described or referenced in the preceding sections. All codes and variables are described in detail in the Con Edison Data Dictionary. The term "enter" appears in the data sheet coding instructions for all variables which require review of the data dictionary for appropriate codes. The term "record" indicates no further information is required in order to complete the coding. The abbreviation N/A means the variable is not applicable to this study and is not entered or recorded.

5.2 CODING INSTRUCTIONS

Coding instructions for each card type are given below. Definitions for each variable and corresponding codes for each variable can be found in the Con Edison Data Dictionary. All entries should be made neatly with only one symbol per data block. The individual whose initials are entered on the data sheet is responsible for assuring the legibility of all entries.

5.2.1 Coding for Header Information

VARIABLE NAME	INSTRUCTIONS
TASK_CD	43 Preprinted
SAMPLE	Preprinted
GEAR	036 box trap
YEAR	11 or 12

5.2.2 Source Card Type S1

Source card type S1 is used to record field sampling information. NOTE: N/A = not applicable, therefore not recorded.

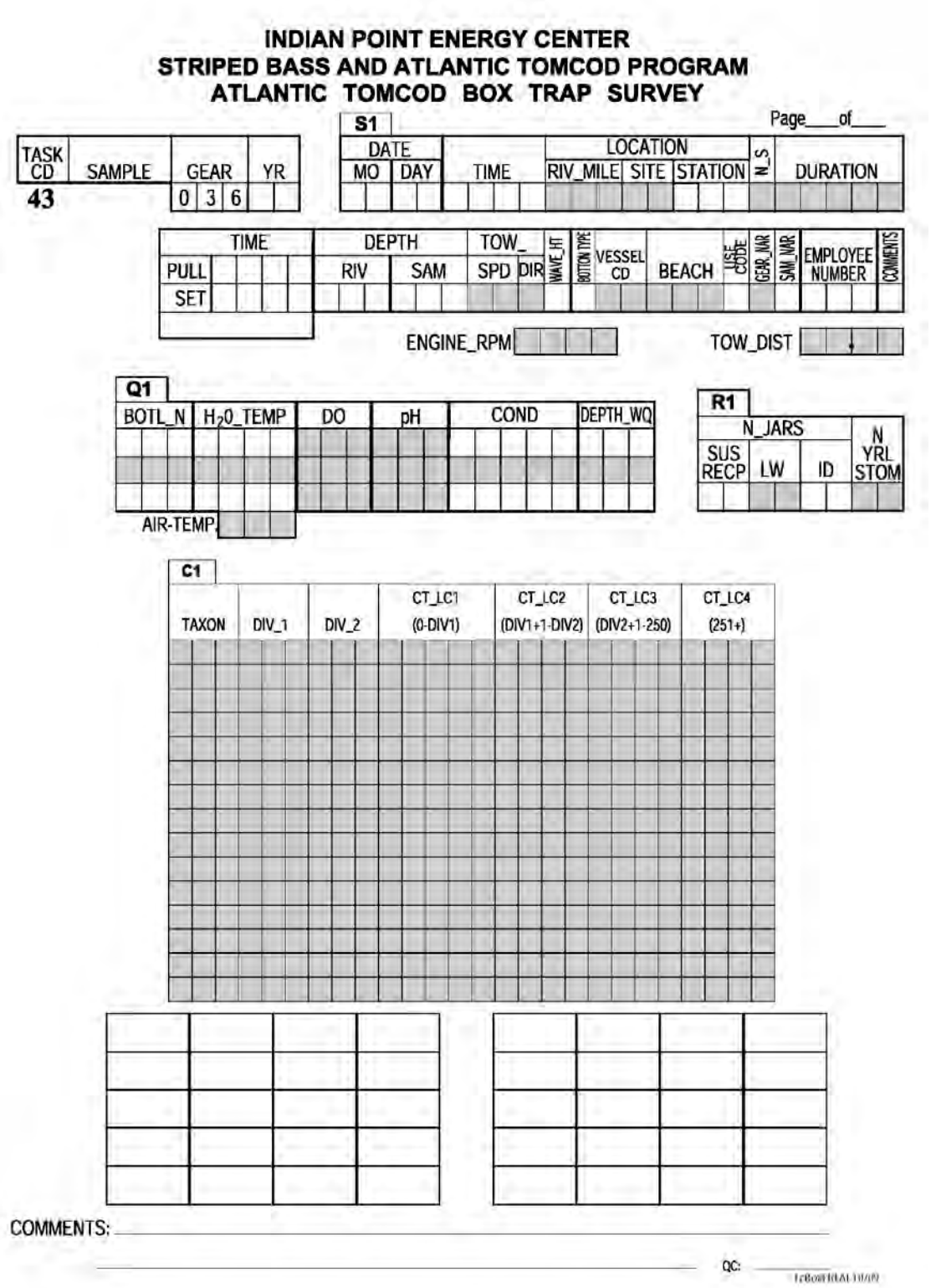


Figure III-1. Field Data Sheet for the Atlantic tomcod box trap program.
(page 1 of 2)

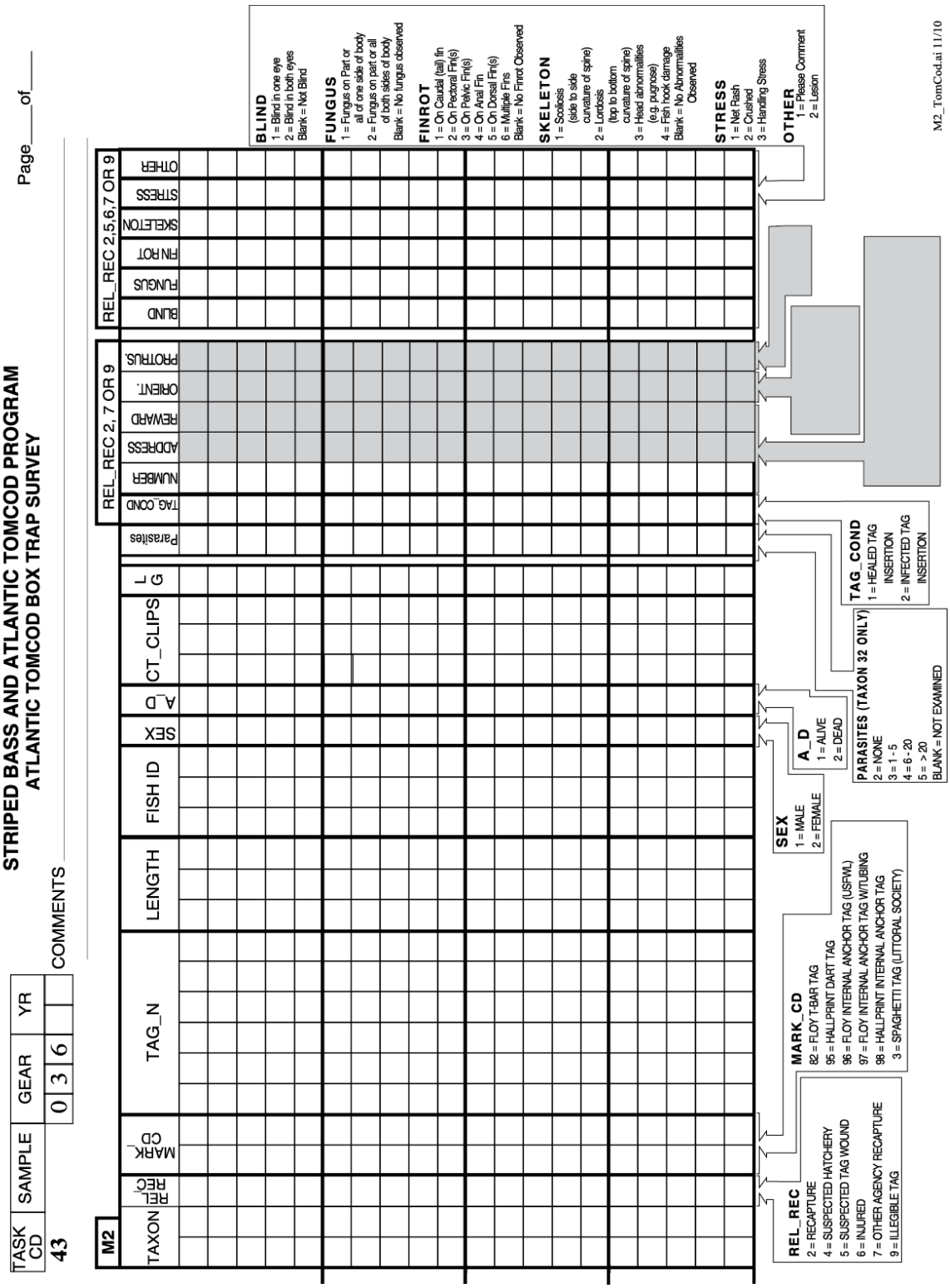


Figure III-1. (page 2 of 2)

VARIABLE NAME	INSTRUCTIONS
SOURCE CARD TYPE	Preprinted S1
DATE	Record date (Mo/Day) of sample collection
TIME	Record time of the collection using 24-hour clock
LOCATION: RIV_MILE	N/A (Note: will be computer generated)
LOCATION: SITE STATION	N/A (Note: will be computer generated) N/A (Note: will be computer generated) Enter appropriate code for Normandeau Field Station of collection (see Table III-1). Con Edison three digit station codes will be computer generated for the SAS files.
N_S	N/A
DURATION	N/A
PULL_TIME	Record time box trap was removed from water for sample processing using 24-hour clock
SET_TIM	Record time box trap was returned to water for sample processing using 24-hour clock
DEPTH_ SAM RIV	 Record sampling depth in feet Record river depth in feet
TOW_ SPD DIR	 N/A N/A
WAVE_HT	Enter code for estimated wave height: 1 = calm to 1/2 ft 2 = light chop (>1/2 ft to 1 ft) 3 = heavy chop (>1 ft to 2 ft) 4 = large waves (>2 ft)
BOTM_TYP	Enter code for bottom type: 1 = sand 2 = mud 3 = vegetation 4 = debris 5 = brick 6 = gravel less than 3" 7 = gravel greater than 3" 8 = mussel/oyster bed 9 = other
VESL_CD	N/A
BEACH	N/A
USE_CODE	Enter appropriate use code:

VARIABLE NAME	INSTRUCTIONS
	1 = no sampling problems 2 = sampling problems, but markable striped bass or Atlantic tomcod caught 5 = sampling problems, no markable striped bass or Atlantic tomcod caught, i.e. void
GEAR_NAR	N/A
SAM_NAR	Enter code explaining catch: Blank = not a laboratory sample 1 = laboratory sample 2 = no catch 3 = laboratory processing problems
INITIALS	Record employee number of individual responsible for sample collection
COMMENTS	Record any pertinent information not recorded elsewhere on back of sheet. Check comments block if comments may affect data interpretation
ENG_RPM	N/A
TOW_DIST	N/A

5.2.3 Source Card Type Q1

Source card type Q1 is used to record water quality data.

NOTE: N/A = not applicable to present task, therefore not recorded.

VARIABLE NAME	INSTRUCTIONS
SOURCE CARD TYPE	Preprinted Q1
BOTL_NO	Record water quality sample bottle number (if used)
H20_TEMP	Record water temperature to the nearest 0.1, degrees Celsius
D_O	N/A
pH	N/A
COND	Record conductivity to the nearest scale unit in microseimens per centimeter (μS/cm)
DEPTH_WQ	Record depth (in feet) at which the water quality sample was taken
AIR_TEMP	Record air temperature (°C) at time of sample collection

5.2.4 Source Card Type R1

Source card type R1 is used to record the type and number of jars which contain biological sample(s).

NOTE: N/A = not applicable to present task, therefore not recorded.

VARIABLE NAME	INSTRUCTIONS
SOURCE CARD TYPE	Preprinted R1
NO. OF JARS SUS_RECAP	Record number of jars or plastic bags containing fish which are suspected recaptures
LW	N/A
ID	Record number of jars containing fish for identification and enumeration
NO YRL STOM	N/A

5.2.5 Source Card Type C1

Source card type C1 is used to record total catch per length class data for fish processed in the field. This information is computer generated.

VARIABLE NAME	INSTRUCTIONS
SOURCE CARD TYPE	Preprinted C1
TAXON	Enter appropriate taxon code. Only Atlantic tomcod (taxon=32) and striped bass (taxon=30) will be enumerated.
DIV_1	N/A (Note: will be computer generated)
DIV_2	N/A (Note: will be computer generated)
CT_LC1	N/A (Note: will be computer generated)
CT_LC2	N/A (Note: will be computer generated)
CT_LC3	N/A (Note: will be computer generated)
CT_LC4	N/A (Note: will be computer generated)
COMMENTS	Record any pertinent information not recorded elsewhere (only check box if comments may affect data interpretation)

5.2.6 Source Card Type M2

Source card type M2 is used to record mark/recapture and length/weight data for fish processed in the field (see Section II-4.0 for special handling of sturgeon spp.)

NOTE: N/A = not applicable to present task, therefore not recorded.

VARIABLE NAME	INSTRUCTIONS
COMMENTS	Record any pertinent information not recorded elsewhere (only check if comments may affect data interpretation)
SOURCE CARD TYPE	Preprinted M2
TAXON	Enter 32 for Atlantic tomcod or 30 for striped bass
REL_REC	Enter appropriate release/recapture code: 1 = released after marking 2 = recapture from present box trap program. Fish released alive in field. 3 = lab fish for biocharacteristics work-up (NOTE: SAM_NAR must equal 1) 5 = recapture from previous program 6 = other (fish not marked, or fish given to researchers)
MARK_CD	Enter mark code (MARK_CD = 90 or 91). (Orange=MARK_CODE 90 Visual Implant Tag, Yellow=MARK_CODE 91 Visual Implant Tag)
TAG_N	Enter the visual implant tag number for individual fish tagged
LENGTH	Record length to the nearest mm for each fish examined in the field.
FISH_ID	Record consecutive FISH_ID for each fish tagged with visual implant tags and each recaptured Atlantic tomcod.
SEX	1 = male 2 = female Blank = not observed
A_D	Enter appropriate alive/dead code for fish at time of capture: 1 = alive 2 = dead
CT_CLIPS	Record total count of fish released (**finclips only**), recaptured or taken to lab. This is only completed when some or all of the fish in the sample are not tagged. If the entire catch of the sample is tagged with visual implant tags, this can be left blank.
LG	Record length group category (1 through 8) for Atlantic tomcod **finclips only** when some or all of the fish in the sample are not tagged. If the entire catch of the sample is tagged with visual implant tags, this can be left blank.
PARASITES	2 = no external parasites observed 3 = light, 1 to 5 external parasites 4 = moderate, 6 to 20 external parasites

VARIABLE NAME	INSTRUCTIONS
	5 = heavy, >20 external parasites blank = not examined
TAG_COND	Enter the code for the condition of the visual implant tag insertion site for REL_REC = 2 or 5 Atlantic tomcod: 1 = Healed tag insertion 2 = Infected tag insertion
NUMBER	Enter the code for the legibility of the tag number as implanted in the fish: 1 = one or more digits **not** legible 4 = **all** digits completely legible
ADDRESS	N/A
REWARD	N/A
ORIENTATION	N/A
PROTRUSION	N/A
BLIND	Enter the code for the condition of each REL_REC = 2 or 5 Atlantic tomcod with respect to blindness: 1 = blind in one eye 2 = blind in both eyes blank = not present
FUNGUS	Enter the code for the condition of each REL_REC = 2 or 5 Atlantic tomcod with respect to body fungus (lymphocystis): 1 = fungus on part or all of one side of body 2 = fungus on part or all of both sides of body blank = not present
FINROT	Enter the code for the condition of each REL_REC = 2 or 5 Atlantic tomcod with respect to fin rot: 1 = fin rot on caudal (tail) fin 2 = fin rot on pectoral fin(s) 3 = fin rot on pelvic fin(s) 4 = fin rot on anal fin 5 = fin rot on dorsal fin(s) 6 = multiple fins blank = not present
SKELETON	Enter the code for the condition of each REL_REC = 2 or 5 Atlantic tomcod with respect to skeletal abnormalities: 1 =scoliosis (side to side curvature of spine) 2 =lordosis (top to bottom curvature of spine) 3 =head abnormalities (e.g. pugnose) 4 = fish hook damage to mouth or gills (pin hooked) blank = none present
STRESS	Enter the code for the condition of each REL_REC = 2 or 5 Atlantic tomcod with respect to stress:

VARIABLE NAME	INSTRUCTIONS
	1 = net rash 2 = crushed or cut 3 = handling stress blank = none present
OTHER	Enter the code for the condition of each REL_REC = 2 or 5 Atlantic tomcod with respect to other observed factors relating to poor condition that are not already coded: 1 =if other injury is present, describe injury in COMMENTS 2 = tumor or lesion on body

SECTION IV. LABORATORY STANDARD OPERATING PROCEDURES FOR THE HUDSON RIVER STRIPED BASS PROGRAM

1.0 INTRODUCTION

This laboratory program provides biocharacteristics data and stomach contents analysis for striped bass which were dead or badly injured at the time of field collection. Biocharacteristics analysis will include length, weight, sex, and sexual maturity. Scales will be taken and archived with those from tagged striped bass for age determination (Section V). Biocharacteristics information and stomach contents will be determined on a maximum of 10 fish per sampling day. Stomach contents analysis will determine the presence or absence of vertebrates and invertebrates, and if vertebrates present are Atlantic tomcod. In addition, fecundity analysis will be performed on all dead or severely stressed gravid (ripe) female striped bass ≥750 mm TL.

2.0 SAMPLE PROCESSING - STRIPED BASS

2.1 LENGTH, WEIGHT, SEX AND SEXUAL CONDITION OF STRIPED BASS

Length, weight, sex, and sexual condition are determined for all dead or badly injured striped bass.

Length, weight, sex, and sexual condition are determined for all dead striped bass used for stomach contents analysis (up to 10 fish per sampling day).

2.1.1 Equipment

- measuring board graduated in millimeters
- balance with 0.1 g precision
- Dissecting tools
- Length/weight/sex laboratory data sheets (card type LW2)

2.1.2 Sample Preparation

Fish are processed in fresh condition on the day they are collected. If they cannot be processed fresh they are refrigerated and worked up within 24 hours of collection. Laboratory schedules are checked the day fresh striped bass arrive at the lab. If schedules indicate the fish will be held more than 24 hours, fish will be placed in the freezer the day they arrive. All striped bass ≥750 mm TL will be processed within 24 hours.

2.1.3 Sample Analysis

Specimens are maintained in the same sequence throughout the procedure so that (1) each length measurement will be associated with the weight and sex of the same specimen, and (2) quality control determination can be made on an individual specimen basis. Individual specimens will be assigned a unique identification number and processed in the following manner:

1. Measure maximum total length to the nearest millimeter. The length of the fish in fresh condition as recorded on the field data sheet is considered the correct length unless large discrepancies are noted. These field lengths are subjected to a 10% AOQL inspection plan.

2. Determine weight of fish < 500 g to the nearest 0.1 g and fish $500 g to the nearest 1 g. (The fish should not have been dissected before this step, to avoid affecting the weight by loss of body fluids, etc.) Assistant should check quality control log to determine if any of these fish are to be reanalyzed for weight measurement prior to next step.

3. Make longitudinal abdominal incision from vent to isthmus passing through the axillary process.

4. Determine the sex and sexual condition by examination of the gonads using the criteria in Table IV-1.

5. Record data on LW2 data sheets (Figure IV-1).

2.2 STRIPED BASS STOMACH CONTENTS ANALYSIS

Examine the stomach contents of a maximum of 10 dead striped bass per sampling day to determine the absence or presence of vertebrates and invertebrates. If more than 10 striped bass are brought to the lab, randomly select a subsample of 10. Stomach contents should be analyzed on all dead striped bass ≥750 mm TL. When vertebrates are present, determine if they are fish, and, if so, whether they are Atlantic tomcod.

2.2.1 On the lab major species food habit processing data sheet (Card Type FH1, FigureIV-2) record sample number and Fish ID number from the label associated with each fish. Record fish length from the field M2 card type.

2.2.2 If striped bass samples arrive late at the lab, fish will be put in plastic bags by sample number and stored in the refrigerator. During warm weather, fish will be stored on ice to retain freshness until they are refrigerated or frozen at the lab.

2.2.3 Sample Preparation and Stomach Contents Analysis

1. Make an abdominal incision from the vent to the isthmus.

2. Make transverse cut on left side through isthmus and behind pharyngeal arch to expose side view of viscera (exposes more esophagus anteriorly).

3. Cut the esophagus anteriorly and lift out the entire digestive tract separating and discarding unwanted visceral organs. Also cut away intestinal tract just posterior to stomach.

4. Expose stomach contents by making incision from esophagus through stomach cavity (avoid cutting food material in stomach).

5. Remove food material into dissecting pan or petri dish by rinsing or with forceps.

6. Examine stomach contents and record presence or absence of vertebrates and invertebrates.

7. If vertebrates are present determine and record whether or not the remains are fish and, if so, are they Atlantic tomcod. Compare vertebrae remains with prepared Atlantic tomcod skeletal specimens noting vertebral counts, characteristics of the neural and hemal spines of the vertebrae, undamaged fin rays, jaw structures, gill values or other vestigial remains.

Table IV-1. Criteria for Determining Sex and State of Maturity of Striped Bass.*

State of Maturity	Code	Females	Males
Gravid or milting (ripe)	1	Ovaries full of yellowish granular eggs that are partially translucent. Eggs can be released when ovary is compressed.	Testes white, less firm in texture, and if compressed will readily milt.
Ripe and running	2	Adult prepared to spawn immediately; expulsion of eggs with little provocation.	Adult prepared to spawn immediately; expulsion of milt with little provocation.
Partially spent	3	Ovaries somewhat flaccid and convoluted, with a variable number of eggs left. Ovarian membrane somewhat vascular.	Testes whitish, somewhat flaccid and convoluted, with free flow of milt.
Spent	4	Ovaries flaccid, few translucent eggs left. Ovarian membrane very vascular or sac-like.	Testes brownish white, flaccid, convoluted, with no flow of milt upon compression.
Immature	5	Ovaries very small and stringlike, thicker than testes, somewhat opaque and gelatinous in appearance.	Testes very small and stringlike, thinner than ovaries, somewhat translucent, and extremely tender.
Not gravid or not milting (Resting)	6	Underdeveloped ovaries in an adult female. Ovaries larger, more firm, opaque, and relatively thick. No eggs discernible to naked eye.	Underdeveloped testes in an adult male. Testes larger, more firm, opaque, but still tender.
Semi-gravid semi-milting (developing)	7	Subripe females heading into spawning season. Ovaries considerably larger, yellow, granular in consistency. Eggs discernible to naked eye, but not readily released when ovary is compressed.	Subripe males heading or into spawning season. Testes considerably larger, white, firm in texture, but milt not running.

*From Con Edison Data Dictionary

2.3 STRIPED BASS SCALE SAMPLES

Scale samples are removed from all striped bass ≥100 mm TL that died in the field and have been taken to the laboratory for biocharacteristics and food habits analyses.

2.3.1 Equipment

- dissecting tools
- scale envelopes

2.3.2 Scale Sample Selection

Remove at least 10-20 scales from both the left and right sides of each fish. Scale samples are removed from an area of the body located midway between the lateral line and the notch between the spiny and soft dorsal fins. Scales taken from the left side are placed in one envelope and scales taken from the right side are placed in a second envelope. Label each envelope with the side the sample came from (LEFT or RIGHT), task code, sample number, FISH_ID number, length, and date of capture. Place a rubber band around both scale envelopes before archiving the samples. Remember, the left or right side of the fish is determined from the fish's perspective while in the swimming position (viewed from the dorsal surface).

2.4 STRIPED BASS FECUNDITY

Fecundity will be determined for all gravid female striped bass ≥750 mm TL that died during this program. Processing of these fish must occur within 24 hours of collection, and the fish must be chilled and not frozen until processing occurs. Striped bass fecundity will not be performed during the 2010-2011 Hudson River Striped Bass Program.

2.4.1 Equipment

- dissecting tools
- balance graduated in grams, with 0.01 g precision
- formalin
- vials or small jars
- petri dishes
- filter paper
- laboratory fecundity and egg diameter data sheets (card type ED2, Figure IV-3).

2.4.2 Sample Preparation

1. Make an incision in the body wall to expose the gonads.
2. Before the gonads are preserved, determine sex and state of maturity by examining them, using the criteria in Table IV-1.

3. Remove the gonads and preserve them in 10% formalin for at least one month, labeled with length, weight, station, capture date, specimen number, sample number, tag type, and tag number. If necessary, cut ovary wall in several places to insure penetration by preservative.

4. After the gonads have been preserved for at least one month, gently rinse off the preservative in a fine-mesh sieve and transfer the gonads onto filter paper and paper towels to drain for five minutes.

5. Place a clean dish on the balance and tare the balance to zero.

6. Place the two gonads on the tared dish and weigh them to the nearest 0.1 g.

7. Record gonad weight on a lab fecundity and egg diameter data sheet.

8. After the total ovary weight has been determined, the right ovary (fish facing same direction as observer, dorsal side up) is cut transversely midway along the longitudinal axis. If the right ovary is not suitable for subsampling the left ovary may be used. A triangular section 1 to 2 mm thick and consisting of 1/8 of the cross section of the ovary is removed as an aliquot.

9. After the balance is tared and verified the aliquot is weighed to the nearest 0.01 g. A second independent weight reading is made to verify the aliquot weight measurement.

10. The eggs in the aliquot are manually separated from the ovarian tissue and counted. Striped bass ovaries contain two size groups (diameters) of eggs. The size difference in these two groups is obvious and only those eggs from the larger size group are counted. Broken eggs, judged to be 50% or more intact are counted.

11. Record data on a lab fecundity and egg diameter data sheet.

2.5 STRIPED BASS WITH SUSPECTED TAG WOUNDS (REL_REC = 5)

All striped bass suspected as having a possible tag wound at the ventro-lateral tag insertion site, but no tag streamer was observed, are assigned a release/recapture code of REL_REC = 5 by the field crew. These REL_REC = 5 fish are killed, properly labeled, and taken to the laboratory for autopsy (see Section II). The purpose of the autopsy is to determine if the tag anchor is still present in the body cavity of the fish, and if present to read the tag number on the anchor. If the tag anchor is found, it is assumed that the external streamer was cut by a fisherman and mailed to the return address. If the anchor is not found, the wound is examined to determine the nature of the scar tissue, presence of infection, and other gross anatomical features that will lead to a determination of whether the wound is unrelated to tagging or due to the shedding of the tag and anchor.

2.5.1 REL_REC = 5 striped bass are received in the laboratory in fresh condition and are either worked up immediately or are frozen for autopsy at a future date.

2.5.2 REL_REC = 5 striped bass are processed for length, weight, sex, and sexual condition as described in Section IV-2.1 and stomach contents (Section IV-2.2). A scale sample is taken from

each REL_REC = 5 fish as described in Section IV-2.3, and fecundity analysis (Section IV-2.4) is conducted if appropriate.

2.5.3 Examine the external tag wound site of REL_REC = 5 striped bass to determine if the wound is healed or infected. Enter the external condition of the tag wound (TAG_COND) on the MR5 data sheet (Figure IV-4) and describe the location, shape and condition of the external wound in the comments on the MR5 data sheet.

2.5.3.1 Is the suspected tag wound observed at the same external location as the tag insertion site (see Section II-2.9.2.2)? If yes, write "same as tagging site" in the comments on the MR5 data sheet.

2.5.3.2 If the external location of the suspected tag wound is not the same as the tag insertion site, write the following in the comments on the MR5 data sheet under External Wound Location:

- The distance (in mm) from the anterior-most part of the wound to the vent.
- The distance (in mm) from the distal end of the depressed pelvic fin to the vent.
- Number of scale rows above the mid-ventral line to the wound.

2.5.3.3 The external wound shape should be described in the MR5 data sheet comments as:

- Straight, oval or some other shape.
- If the wound is straight and incision-like, describe its orientation with respect to the longitudinal and vertical planes of the fish.

2.5.3.4 The description of the external wound should be written in the MR5 data sheet comments as:

- Length of wound along the long axis of fish (in mm).
- Width of wound along the dorso-ventral plane of the fish (in mm).

2.5.3.5 The condition of the external wound should be written in the MR5 data sheet comments as:

- Completely healed scar tissue.
- Open wound that is infected.
- Open, fresh wound (no infection).
- Partially healed open wound.

2.5.4 Examine the internal condition of the ventro-lateral tag insertion site of REL_REC = 5 striped bass by making an incision with a scalpel through the lateral wall of the body cavity. Fold the tissue down to expose the internal tag insertion site and examine the condition of the tissue. Determine if scar tissue is present, and if internal organs exhibit damage or scar tissue. If no internal wound is observed, the wound was not due to tag insertion. Describe the location, shape and condition of the wound in the comments on the MR5 data sheet.

2.5.4.1 If an internal wound is present describe its location in the comments on the MR5 data sheet as:

- Distance from posterior end of body cavity to posterior edge of wound (in mm).
- If the internal wound is directly opposite the external wound write "opposite external wound" in the comments.

2.5.4.2 Describe the shape of the internal wound in the MR5 data sheet comments as:

- Straight, oval or some other shape.
- If the internal wound is straight and incision-like, describe its orientation with respect to the longitudinal and vertical planes of the fish.

2.5.4.3 Describe the dimensions of the internal wound in the MR5 data sheet comments as:

- Length of the wound along the long axis of the fish (mm).
- Width of the wound along the dorso-ventral plane of the fish (mm).

2.5.4.4 Describe the condition of the internal wound as:

- Is connective tissue present at the wound site?
- Are organs affected? Which ones?
- Completely healed with scar tissue.
- Open wound that is infected.
- Open wound that is fresh (not infected).
- Partially healed open wound.

2.5.5 Search for the presence of the tag anchor in the body cavity of each REL_REC = 5 striped bass. Tag anchors are often found encapsulated in scar tissue attached to the inner body wall. Tag anchors have also moved and may be found almost anywhere in the body cavity and organ systems, including the spleen, air bladder, sex organs, liver, kidneys and gastrointestinal tract. Remove the tag anchor (if present) and record presence of the anchor (ANCHOR), the type of tag (MARK_CD) and tag number (TAG_N) on the MR5 data sheet. Describe the location of the anchor and organs involved in the comments section of the MR5 data sheet.

2.5.5.1 Tags or tag anchors removed from all REL_REC = 5 striped bass should be placed in a scale envelope, labeled with Sample Date, Task Code, Sample, Fish ID, REL_REC, and Tag Number, and stored with the scale samples.

2.5.6 Determine if the suspected tag wound on each REL_REC = 5 striped bass was due to tagging, or if the wound was not related to tagging.

2.5.6.1 If a tag anchor is found in the fish, it is assumed that the tag external streamer was removed by a fisherman and mailed to the return address. Determine if the streamer was cut, as indicated by a stub of monofilament or streamer material remaining prior to the anchor, or if the streamer was pulled from the anchor. Enter this information on the MR5 data sheet under the variable STREAMER.

2.5.6.2 If the tag anchor is not found, determine if the tag was shed or if the wound was an anomaly unrelated to tagging. A wound from a shed tag will typically exhibit an external, longitudinal scar from the tag insertion site to the posterior end of the body cavity. Scar tissue will also be present on the internal body wall along the track of the external scar. If there is no internal wound directly opposite the external wound, the external wound could not have originated from the tagging process. A wound unrelated to tagging will often be in a location slightly different than the tag insertion site (it may be on the wrong side of the fish), and it may be superficial with no internal scar tissue or penetration into the body cavity. Enter your determination of the origin of the wound under the variable TAG_SHED on the MR5 data sheet. **Please note that all tag wounds on striped bass must be classified as either originating from a tag or not originating from a tag in the judgment of the examiner**.

2.5.7 Autopsy of the tag insertion site of all REL_REC = 5 striped bass will be performed by the laboratory supervisor.

3.0 SAMPLE HANDLING/SAMPLE CONTROL

All striped bass which are dead or severely injured will be kept on ice and returned to the laboratory for further processing or disposal. During length, weight and sex data collection, specimens will be maintained in the same sequence throughout the procedure so that (1) each length measurement will be associated with the weight and sex of the same specimen, and (2) quality control determinations can be made on an individual specimen basis. From these specimens, all striped bass will be analyzed for biocharacteristics and up to 10 per day for stomach contents. Biocharacteristics and stomach contents will be examined for all fish ≥750 mm TL, and gonads from ripe females (≥750 mm TL) will be removed and preserved in 10% formalin for fecundity analysis. Scales will be removed and placed in labeled scale envelopes. Once the data for length, weight, sex and sexual condition have been verified by quality control checks and gonad specimens for fecundity analysis are obtained, those specimens will be disposed of in an acceptable manner. Gonads for fecundity analysis must be stored for at least one month in 10% formalin before processing can begin. After analysis, the subsample, including all ovarian tissue and eggs, is placed in a small container filled with 10% formalin and labeled with date of capture and fish identification number. The subsample container is placed with the complete gonad in the original sample container and stored for QC inspection. All Atlantic tomcod recovered from striped bass food habits study will be stored in vials containing 10% formalin and labeled with date of capture, sample number, and fish identification number.

4.0 DATA HANDLING - STRIPED BASS LABORATORY DATA

All completed data sheets are reviewed for completeness and legibility by the person who originally entered the data. Data sheets are then transferred to the laboratory operations supervisor for quality control checks.

The following data sheets are used for striped bass laboratory tasks.

CARD TYPE	TASK
LW2	Striped bass stock assessment (length, weight, sex, maturity) (Figure IV-1)
FH1	Striped bass food habits study (Figure IV-2)
ED2	Striped bass fecundity (fecundity, egg diameter) (Figure IV-3)
MR5	Striped bass tag anchor examination (Figure IV-4)

4.1 LABORATORY DATA SHEET CODING INSTRUCTIONS

Coding instructions for each laboratory card type are given below. Definitions for each variable and corresponding codes for each variable can be found in the Con Edison Data Dictionary. All entries should be made neatly with only one symbol per data block. The individual whose initials are entered on the data sheet is responsible for assuring the legibility of all entries.

All limiting values, tolerances, and precision limits are described or referenced in the preceding and following sections. All codes and variables are described in detail in the Con Edison Data Dictionary. The term "enter" appears in the data sheet coding instructions for all variables which require review of the data dictionary for appropriate codes. The term "record" indicates no further information is required in order to complete the coding. The abbreviation N/A means the variable is not applicable to this study and is not entered or recorded.

4.1.1 Source Card Type LW2

Source Card Type LW2 (Figure IV-1) is used to record stock assessment data for all striped bass examined in the laboratory and for striped bass used for fecundity analysis. Stock assessment data will include length, weight, sex, and sexual maturity.

VARIABLE NAME	INSTRUCTIONS
YEAR	Record year of sample collection
SOURCE CARD TYPE	Preprinted LW2
TASK_CD	Enter field task code from which sample originated
SAMPLE	Record field sample number from which sample originated
FISH_ID	Record assigned identification number from M1 orM2 field data sheet
COLL DATE	Record date (mo/day) the sample was collected
LENGTH	Record maximum total length in millimeters
WEIGHT	Record weight in grams to the precision specified in the laboratory operations standard operating procedures
PROC_DT	Record date (mo/day/yr) the sample was processed

Lab Length/Weight/Sex Processing

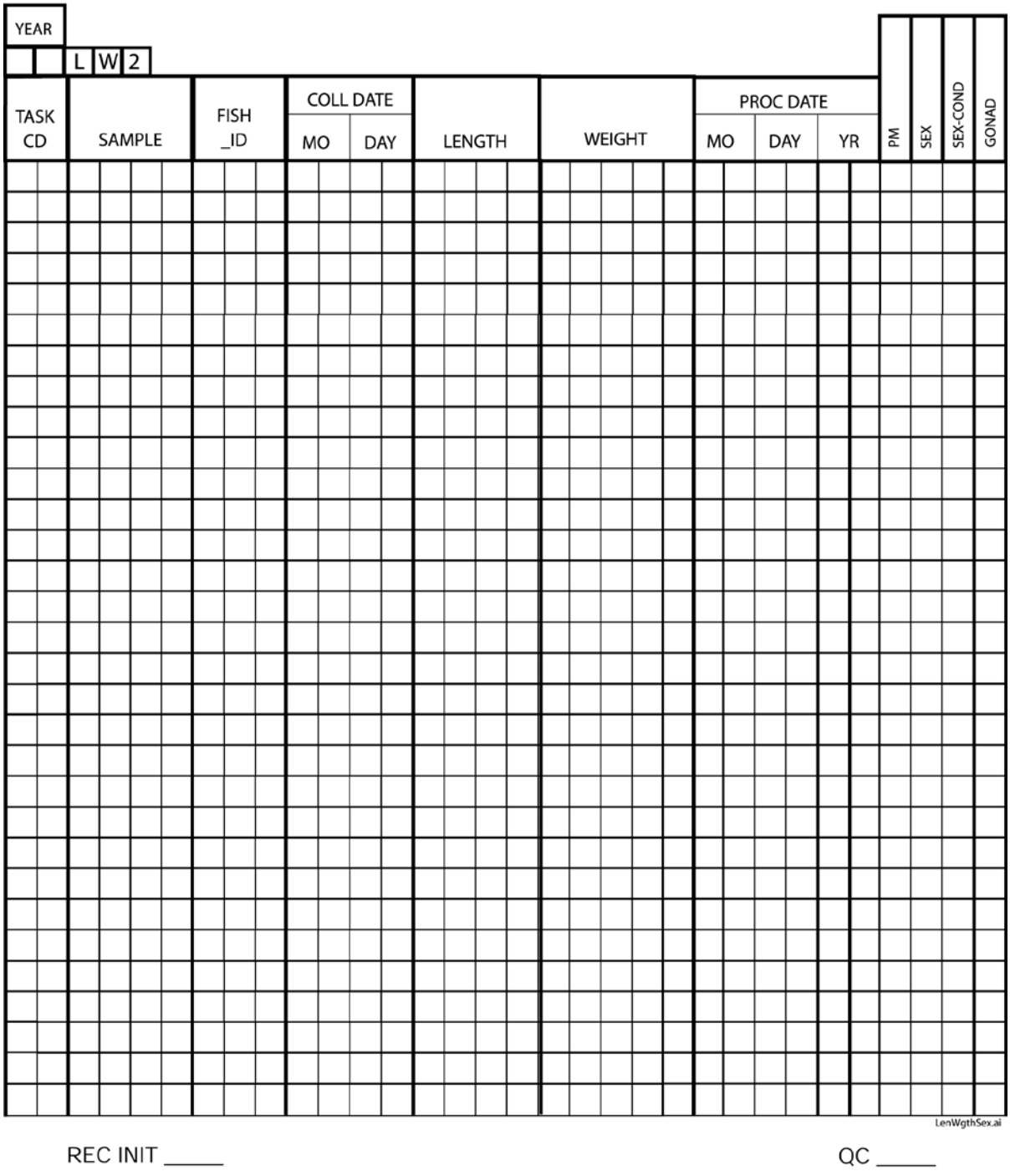


Figure IV-1. Laboratory length, weight, and sex data sheet used during the Hudson River Striped Bass Hatchery and Atlantic Tomcod Programs

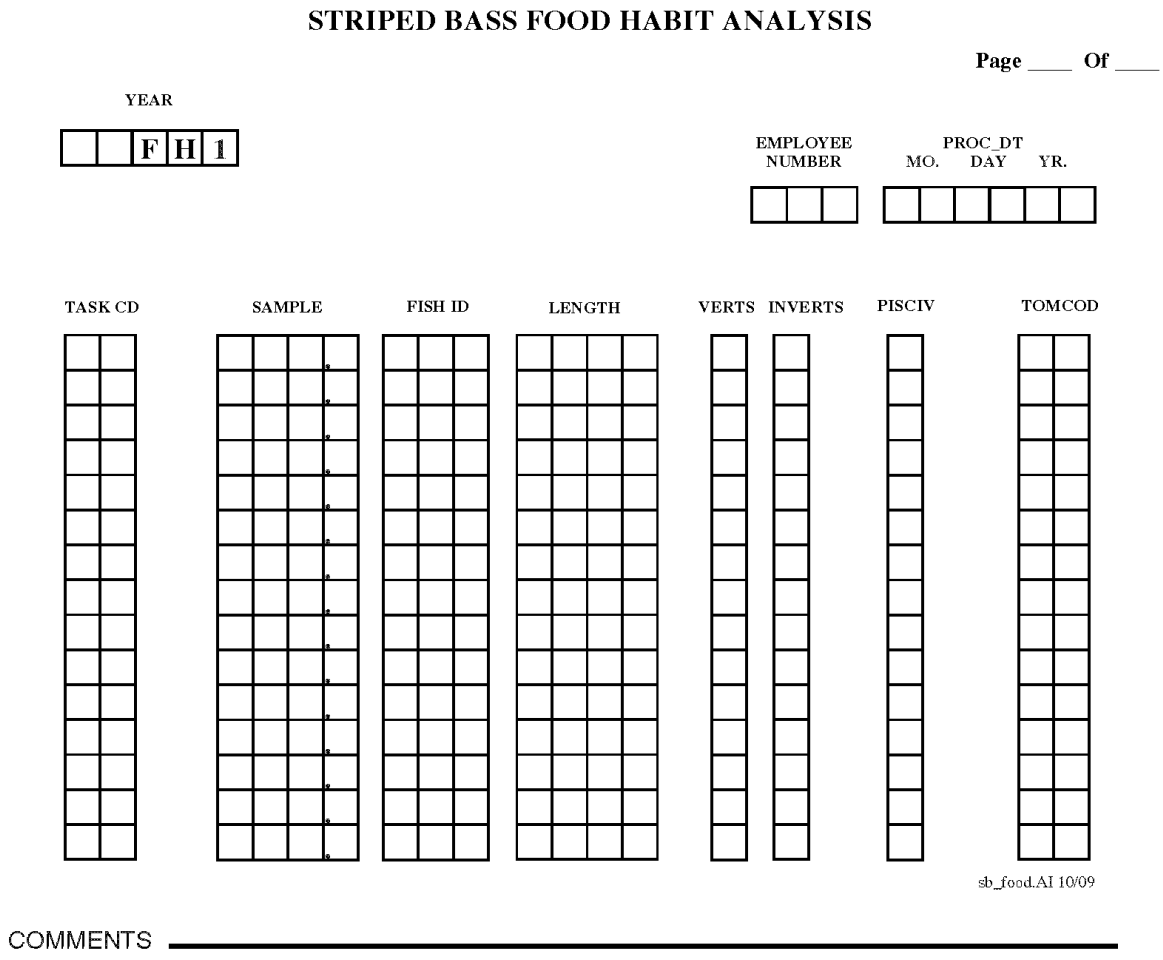


Figure IV-2. Laboratory food habits data sheet used during the Hudson River Striped Bass and Atlantic Tomcod Programs

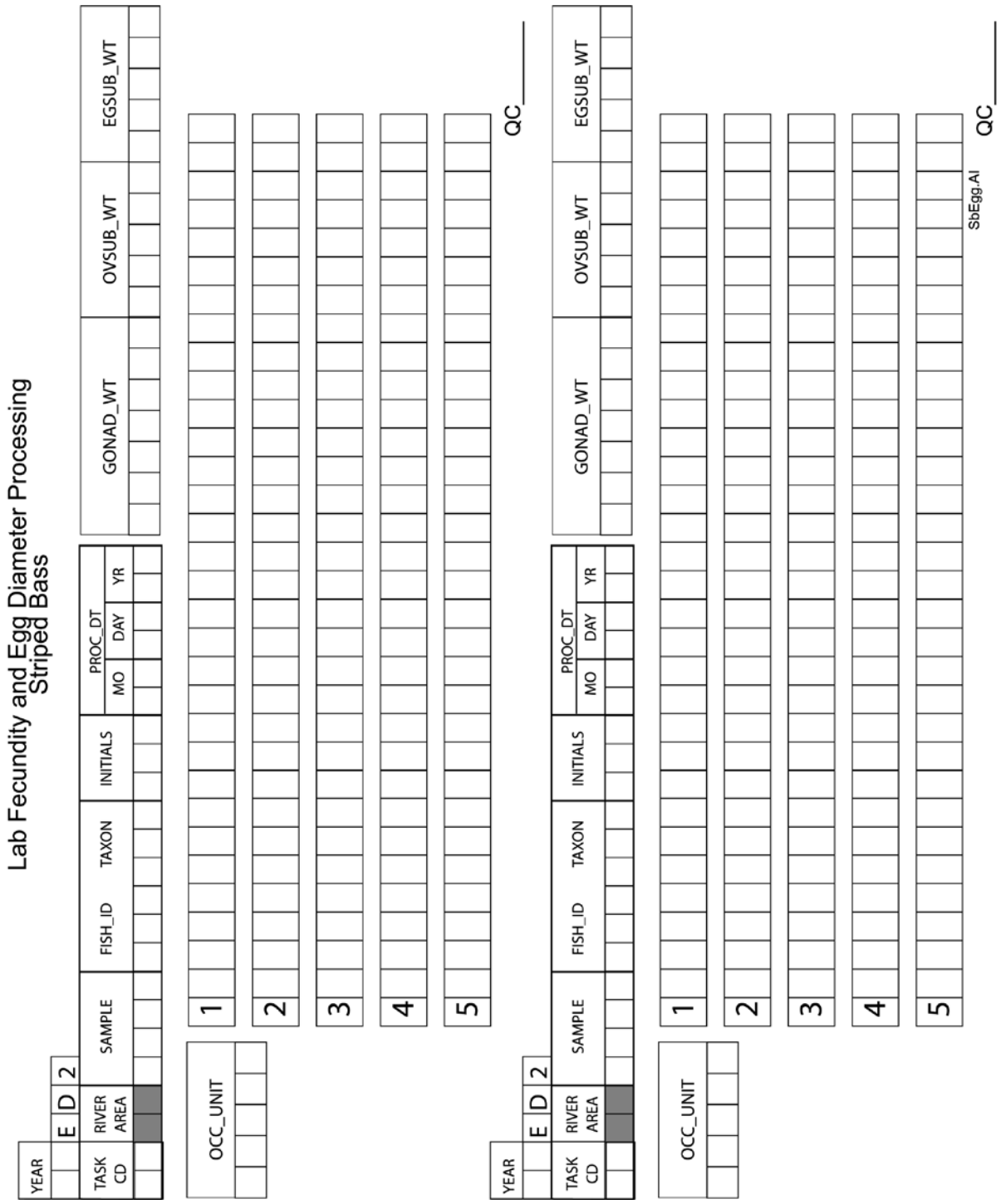


Figure IV-3. Laboratory fecundity and egg diameter data sheet used during the Hudson River Striped Bass and Atlantic Tomcod Programs

Tag Wound Examination Data Sheet
REL_REC = 5 Striped Bass

COLLECTION YEAR	TAXON	EMPLYEE ID NUMBER	PROC_DT MO DAY YR
MR5	30		

TASK_CD	SAMPLE	FISH_ID	LENGTH	REL_REC	MARK_CD	TAG_N	TAG_ COND	STREAMER	ANCHOR	SHED TAG
53										

COMMENTS:

EXTERNAL WOUND LOCATION _____
SHAPE _____
DESCRIPTION _____
CONDITION _____

INTERNAL WOUND LOCATION _____
SHAPE _____
DESCRIPTION _____
CONDITION _____

TAG ANCHOR LOCATION _____
DESCRIPTION _____
CONDITION _____

OTHER COMMENTS _____
_____
_____

Figure IV-4. Striped bass tag wound verification data sheet

VARIABLE NAME	INSTRUCTIONS
PM	Enter appropriate code for state of preservation: 1 = fresh 2 = refrigerated 3 = frozen 4 = formalin 5 = other
SEX	Enter appropriate code for sex: 1= male 2= female 3 = not examined 7 = examined but unable to identify 8 = hermaphrodite
SEX_COND	Enter appropriate code for state of sexual condition (Table IV-1)
GONAD	Enter code indicating availability of gonad for secondary processing i.e. fecundity analysis: 1 = gonad collected for fecundity processing 3 = gonad sample not collected

4.1.2 Source Card Type FH1

Source Card Type FH1 (Figure IV-2) is used to record striped bass food habits.

VARIABLE NAME	INSTRUCTIONS
YEAR	Record year of sample collection
SOURCE CARD TYPE	Preprinted FH1
EMPLOY_NUMB	Record employee number of person performing analysis
PROC_DT	Record date (mo/day/yr) the sample was processed
TASK_CD	Enter 53
SAMPLE	Record sample number from which fish was taken
FISH_ID	Record assigned identification number from LW2 data sheet
LENGTH	Record total length of fish in mm, from LW2 data sheet
VERTS_INVERTS	Enter code for presence or absence of vertebrates and invertebrates in stomach: 1 = present 0 = absent
PISCIV	Record presence or absence of fish in stomach 1 = present 0 = absent
TOMCOD	Record number of Atlantic tomcod present in stomach
COMMENTS	Enter any information pertinent to sample processing

4.1.3 Source Card Type ED2

Source card type ED2 (Figure IV-3) is used to record striped bass fecundity. Egg diameter data are not collected.

VARIABLE NAME	INSTRUCTIONS
YEAR	Record year of sample collection
SOURCE CARD TYPE	Preprinted ED2
TASK_CD	Enter task code from which sample originated
SAMPLE	Record sample number from which fish was taken
FISH_ID	Record FISH ID number from LW2 data sheet
TAXON	Enter 30 for striped bass
INITIALS	Record employee number of person performing measurements
PROC_DT	Record date (mo/day/yr) the sample was processed
GONAD_WT	Record weight of entire preserved gonad to nearest 0.1 g
OVSUB_WT	Record weight of ovary subsample to nearest 0.01 g
EGSUB_CT	Record the number of eggs counted in the ovary subsample
OCC_UNIT	N/A
EGG DIAMETER	N/A

4.1.4 Source Card Type MR5

Source card type MR5 (Figure IV-4) is used to record autopsy results for striped bass recaptured with suspected tag wounds (REL_REC = 5).

VARIABLE NAME	INSTRUCTIONS
YEAR	Record the year of sample collection
TAXON	Preprinted 30 for striped bass
EMP_ID	Record the last three numbers of the employee identification number of the employee performing the analysis
PROC_DT	Record the month, day and year the sample was processed
TASK_CD	Preprinted 53
SAMPLE	Record the sample number from which the fish was taken
FISH_ID	Record the assigned identification number from the label or original field data sheet
LENGTH	Record the total length of the fish in mm from the field data sheet

VARIABLE NAME	INSTRUCTIONS
REL_REC	Enter the release recapture code for the fish from the field data sheet or label
MARK_CD	Enter the appropriate mark code for the tag type from which the anchor originated 82 = Floy T-bar tag 95 = Hallprint dart tag 96 = Floy internal anchor tag (blue or red, oval, hard, plastic disk with no printing) 97 = modified Floy internal anchor tag (blue or red, oval, hard, plastic disk with printed legend) 98 = Hallprint internal anchor tag
TAG_N	Record the tag number if present on the anchor
TAG_COND	Enter code for the external condition of the tag wound site 1 = healed 2 = infected
ANCHOR	Enter code for presence or absence of the internal anchor in body cavity 1 = MARK_CD 96, 97 or 98 anchor was found 2 = MARK_CD 82 or 95 anchor was found blank = anchor not found
STREAMER	If an internal anchor was found, enter code to determine if the streamer was cut or pulled to remove it from the fish 1 = cut 2 = pulled blank = no anchor found
TAG_SHED	Enter code to determine if the wound originated from a shed tag or from causes not related to tagging 1 = shed tag, anchor and streamer missing 2 = anchor found, streamer cut or pulled blank = wound not from a tag

5.0 QUALITY CONTROL – STRIPED BASS BIOCHARACTERISTICS SAMPLES

Quality control plan application is on an individual processor basis. Each processor will start each task at a 100% inspection level and proceed as outlined in Figure IV-5. The "i", "f", "x" and tolerance limits for each laboratory task are defined in Table IV-2. A QC sample is defined as one fish.

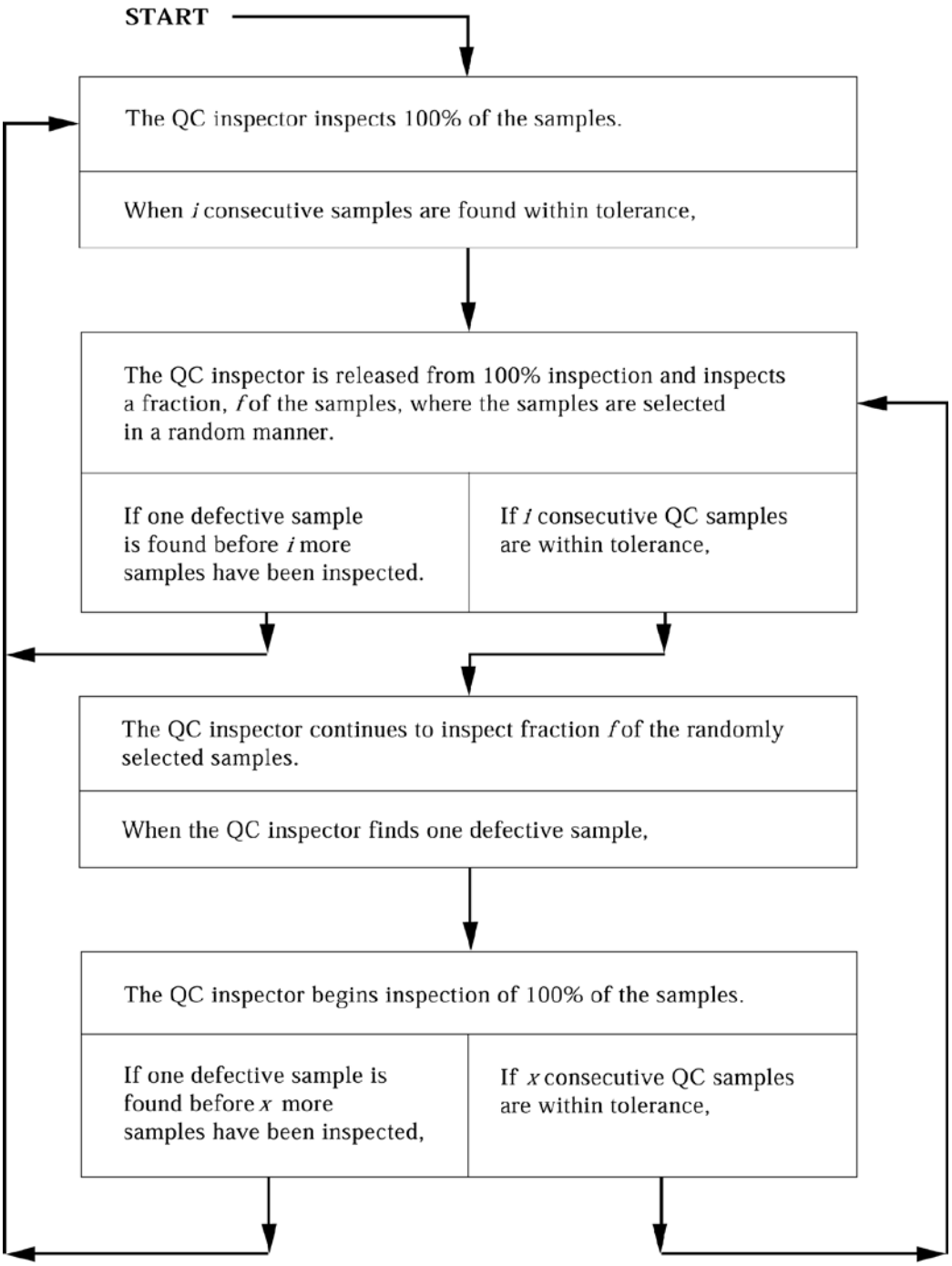


Figure IV-5. Procedures for continuous sampling plan (CSP-V) quality control inspection

5.1 ACCEPTANCE PROCEDURES

Tolerance criteria are presented in Table IV-2. Procedures for determining acceptable quality control comparisons are as follows:

Table IV-2. Task Specific Application of Continuous Sampling Plan V for Striped Bass Laboratory Processing.

Task	CSP-V i	CSP-V f	CSP-V x	Tolerance	QC Sample Definition
Total Length	21	1/15	7	±3%	one fish
Fish Weight	21	1/15	7	±0.3 g if ≤5 g ±3% if >5 g	one fish
Sex	21	1/15	7	±0	one fish
Gonad Weight	12	1/4	4	±0.02 g if <1 g ±3% if >1 g	one fish
Subsample Weight	12	1/4	4	±0.02 g if <1 g ±3% if >1 g	one fish
Egg Count	12	1/4	4	±10%	one fish

- If the original and QC values are within tolerance, the original value is considered acceptable. To calculate percent difference, utilize the following equation:

$$\%\,Difference = \frac{(Original - QC)\,x\,100}{QC}$$

- If the original and QC values are not within tolerance a resolution is required.

Resolutions are performed by a third observer, independent from all previous determinations. The only exception to this rule is that discrepancies in age determinations are resolved by the original and QC processors. If no resolution can be reached, a third person is consulted for resolution. The following procedures apply:

- If the original and resolution values are within tolerance, the original value is considered acceptable. To calculate percent difference, utilize the following equation:
- % Difference = (Original - Resolution)/Resolution x 100
- If the original and resolution values are not within tolerance but the resolution and QC values are within tolerance, the original value is considered unacceptable and replaced with the QC value.

- If agreement within tolerance cannot be reached, the data are voided and are not considered either pass or fail. A replacement sample is selected for inspection from the same lot.
- Data found to be unacceptable are replaced with the correct data.
- QC and resolution data are entered in a task specific log.

6.0 SAMPLE STORAGE

All striped bass will be immediately stored on ice or placed in refrigerators at the field laboratory if the intention is to process fish within 24 hours. If laboratory schedules indicate a holdover of more than 24 hours, fish will be placed in the freezer the day they arrive at the lab. All striped bass used for fecundity analysis will be processed within 24 hours. Once the length, weight, sex and sexual maturity data have been verified by QC checks, the samples are disposed of in a sanitary manner. Only gonads for gonad weight and fecundity analysis are stored in formalin at the field laboratory. These preserved samples should not be stored in an area where the room temperature will fall below 50°F.

7.0 EQUIPMENT CALIBRATION

A calibration and maintenance log will accompany each instrument. The log will include:

- instrument number and identification
- date of calibration
- calibration due date
- initials of the person(s) calibrating the instrument
- standards used
- results, including instrument accuracy at receipt for calibration, adjustments made, instrument accuracy after calibration.

Field instruments will be calibrated at least twice a year with calibration checks being performed generally prior to each day of use (Table IV-3). Laboratory scales and balances will be calibrated once each year. Daily calibration checks will be performed with each use of a scale or balance.

Table IV-3. Field Instrument Calibration Frequency and Tolerance.

Instrument	Frequency of Calibration Checks	Tolerance
Conductivity	Daily	5% of Std
Temperature	Daily	3% of Std
Balance	Daily	$\pm$ 0.01 g

7.1 A&D PRECISION ELECTRONIC BALANCE

Precision and accuracy of the A&D balance is checked annually by Normandeau's Standards Laboratory. Calibration of the balance is checked before each daily use in the following manner:

- The balance's zero is checked and adjusted if necessary
- Weigh the 1 g, 10 g, 50 g, and 100 g class S weights
- A record is kept of all precision and accuracy tests, daily calibration checks, maintenance and repairs including dates activity was performed and initials of individual performing activity.

If a calibration check exceeds the acceptable tolerance limits (Table IV-4), troubleshoot for the cause and reweigh the Class S weights. If the problem cannot be corrected, another balance must be used that will pass the calibration check.

Table IV-4. Class S Weight Tolerance for A&D Balance

Weight	Tolerance
1 g	±0.01 g
10 g	±0.01 g
50 g	±0.05 g
100 g	±0.10 g

SECTION V. SCALE ANALYSIS FOR THE HUDSON RIVER STRIPED BASS PROGRAM

1.0 INTRODUCTION

This section describes conventional age and growth techniques. Scales to be analyzed will be selected by stratified random sampling. Scale samples are only collected from fish ≥100 mm TL. All fish <100 mm TL are assumed to be Age 0+.

Scale samples will be selected for age determination according to a stratified random sampling scheme. Stratified sampling picks scales for age determination based on the number and estimated proportion of Age 1+ fish in each 10 mm TL length increment. Scale samples will also be examined from all striped bass verified to be of hatchery origin to determine age and growth.

2.0 STRIPED BASS AGE AND GROWTH

Age and growth are determined for striped bass scale samples from the Hudson River striped bass program. This section will describe the equipment, sample preparation, sample analyses, and Quality Control procedures used to analyze these scales.

2.1 EQUIPMENT

1. Carver press
2. Thermostatically controlled electric heat plates
3. Press plates: aluminum, stainless steel and cardboard
4. Acetate plates 5x6" grade GG clear extruded
5. Microfiche reader
6. Fish age data sheets (card type AG1)
7. Dissecting binocular microscope w/stage luminator
8. Scale sample envelopes
9. Acetate scribing tool
10. Paper cutter (heavy duty)
11. Timer
12. Dissecting tools, examining dishes

2.2 SAMPLE PREPARATION – ACETATE IMPRESSIONS

1. Select scale samples to be aged from the master scale envelop storage file using the program specific stratified random sample plan. Indicate on the printout which samples have been removed from the file for processing.
2. Number the scale envelopes in the upper right hand corner with the numbers 1 through 10 and process each lot of ten separately.
3. Prepare the acetate plate (5x6") by dividing it into ten equal 1x3" slides with a scribing tool. In the outside corner of each slide, scribe the numbers 1-10 consecutively.
4. Prepare the press plates in order from the outside to inside: aluminum - cardboard - stainless.
5. Clean foreign material (dust etc.) from the acetate plate and place it on top of stainless plate.
6. Tease scales from the envelope #1 and put the scales into an examining dish.
7. Examine the scales under low power. Select 5 or 6 non-regenerated, symmetrical scales and return the unused scales to the scale envelope. If all scales are regenerated, record the sample number, FISH_ID and Scale Use Code=5 in the QC log.
8. Place the selected scales on acetate slide #1 in a single row with all scales oriented in same direction. The sculptured side of each scale (convex surface) faces the acetate plate.
9. Repeat step 6 through 8 for the remaining lot of ten scale samples.
10. Carefully place the top press plates directly on the scales in reverse order of step 4 (Note: the stainless steel plate is always next to the acetate plate)
11. Turn the heating elements in the Carver Press on and adjust the temperature (if not preset) to 200°F.
12. Place the "sandwiched" acetate plate in the carver Press, pump the press to a pressure of 5000 lbs., and set the timer for 5 minutes.
13. After 5 minutes of pressing, remove the acetate sandwich from press and separate the plate. Allow the exposed acetate to cool on the bottom stainless plate (do not attempt to lift the acetate off the bottom stainless plate while hot).
14. When the acetate plate is cool, remove the scales from the individual slides and return scales to their original scale envelopes.
15. Cut the acetate plate into the ten individual 1x3 inch slides, and place the slides into their respective scale envelopes.

2.3 SAMPLE ANALYSIS

1. Remove the acetate slide from the scale envelope and place it in a microfiche reader under high power (46x). Record the microfiche reader number so the appropriate calibration factor can be applied to the scale radius measurements. Examine each scale impression on the slide for the presence of annuli.

2. Select a symmetrical, non-regenerated scale impression for scale radius length measurements. Place the ruled metric scale of the AG1 card on the microfiche screen and align the zero with the center of the scale's focus. The metric scale of the AG1 card should run from the focus approximately through the center of the scale's anterior field.

3. Holding the AG1 card in position on the screen as described in 2 above, place a mark on the metric scale at each annulus and at the anterior edge or scale radius (SR).

4. If scale radius is greater than 200 mm, place a ruler alongside the AG1 card to retain the same line and move the AG1 card up the screen to determine the total scale radius. Record SR on the AG1 card.

5. Remove the AG1 card from the screen and label each mark as follows: A1, A2...Ax, for annulus 1, 2 etc.; and SR for the scale radius if ≤200 mm.

6. Read the measurements for each mark and record the data on the AG1 card.

7. Striped bass birth date in the Hudson River is defined as 1 June. Record the age in years as the number of annuli present. Do not count the annulus in formation on the edge of a scale from a fish captured prior to 1 June.

8. Record the sample and sample processing information as per Section V-4.2.

9. Indicate the scale impression that was used for radius measurements by placing an arrow on the acetate slide below the scale impression using a permanent marker.

10. Return the acetate slide to original scale envelope.

3.0 CONTINUOUS SAMPLING PLAN FOR AGE ANALYSIS OF STRIPED BASS SCALES

A continuous sampling plan providing an AOQL of 4% for age analysis of striped bass will be used (Table V-1). Sample passes QC inspection if the 2nd or 3rd independent reading agrees with the original. Sample fails if 2nd and 3rd independent readings agree and are different from original. If all independent readings vary, the sample constitutes a failure and "best" age resolved or age is left unassigned. Each person aging a striped bass will complete an AGI card and code the QC variable as per Section V-4.2.

Table V-1. Task Specific Application of Continuous Sampling Plan V for Striped Bass Age Analysis.

Task	CSP-V			Tolerance	QC Sample
	i	f	x		
Aging	24	1/10	8	2nd or 3rd reading one scale in agreement with original	sample

4.0 DATA HANDLING – STRIPED BASS AGE AND GROWTH

All completed data sheets are reviewed for completeness and legibility by the person who originally entered the data. Data sheets are then transferred to the Laboratory Operations supervisor for quality control checks.

The AG1 card type data sheet is used for striped bass age and growth data (Figure V-1).

4.1 LABORATORY DATA SHEET CODING INSTRUCTIONS

Coding instructions for each laboratory card type are given below. Definitions for each variable and corresponding codes for each variable can be found in the Con Edison Data Dictionary. All entries should be made neatly with only one symbol per data block. The individual whose initials are entered on the data sheet is responsible for assuring the legibility of all entries.

All limiting values, tolerances, and precision limits are described or referenced in the preceding and following sections. All codes and variables are described in detail in the Con Edison Data Dictionary. The term "enter" appears in the data sheet coding instructions for all variables which require review of the data dictionary for appropriate codes. The term "record" indicates no further information is required in order to complete the coding. The abbreviation N/A means the variable is not applicable to this study and is not entered or recorded.

4.2 SOURCE CARD TYPE AG1

Source Card Type AG1 (Figure V-1) is used to record striped bass age and growth data.

VARIABLE NAME	INSTRUCTIONS
YEAR	Record year of sample collection
SOURCE CARD TYPE	Preprinted AG1
QC	QC = blank = original 1st reading 1 = QC each reading 2 = resolve 3rd reading
TASK_CD	Enter field task code from which sample originated
RIV_AREA	N/A
SAMPLE	Record field sample number from which sample originated

VARIABLE NAME	INSTRUCTIONS
TAXON	Preprinted 30 for striped bass
FISH_ID	Record FISH_ID from scale envelope
INITIALS	Record employee number of person entering data
PROC_DT	Record date (month/day/year) the sample was processed
LENGTH	Record length of fish from scale envelope
WT	N/A
AGE	Record age of fish
SR	Record scale radius x 46, to the nearest mm
AN1-AN11	Record scale radius at ANNULUS 1 x 46, at ANNULUS 2 x 46, etc.

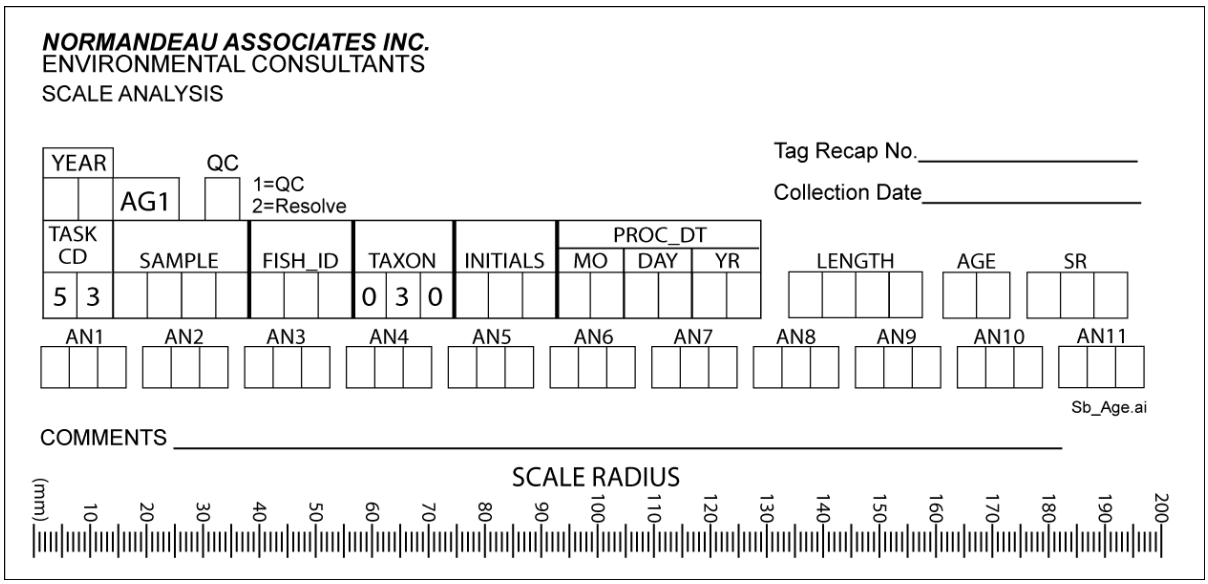


Figure V-1. Laboratory age and growth data sheet used for the Hudson River Striped Bass Program

SECTION VI. WATER QUALITY SAMPLING FOR HUDSON RIVER STRIPED BASS AND ATLANTIC TOMCOD PROGRAMS

1.0 WATER QUALITY SAMPLING REQUIREMENTS

1.1 GEAR REQUIREMENTS

Conductivity and temperature measurements: YSI Model 85 Handheld Oxygen, Conductivity, Salinity and Temperature System or the YSI Professional Plus (in situ).

1.2 YSI MODEL 85 HAND HELD OXYGEN, CONDUCTIVITY, SALINITY, AND TEMPERATURE SYSTEM

1.2.1 Maintenance

1.2.1.1 Maintain the Model 85 handheld water quality system as described in the YSI Model 85 operation manual in Appendix 2.

1.2.2 Calibration

1.2.2.1 Perform daily calibration of the YSI Model 85 handheld water quality system as described in the YSI Model 85 operations manual in Appendix 2.

1.3 YSI PROFESSIONAL PLUS OXYGEN, CONDUCTIVITY, SALINITY AND TEMPERATURE SYSTEM

1.3.1 Maintenance

1.3.1.1 Maintain YSI Professional Plus as described in the YSI Professional Plus manual in Appendix 3.

1.3.2. Calibration

1.3.2.1 Perform daily calibration of the YSI Professional Plus as described in the YSI Professional Plus manual in Appendix 3.

1.4 SAMPLE COLLECTION

Water quality samples will be taken one foot below the surface and one foot above the bottom for each trawl or box trap sample.

Temperature will be recorded to the nearest 0.1°C, and conductivity to the nearest appropriate units relative to the scale factor in µS/cm.

SECTION VII. LABORATORY STANDARD OPERATING PROCEDURES FOR THE HUDSON RIVER ATLANTIC TOMCOD PROGRAM

1.0 INTRODUCTION

Atlantic tomcod from one sample per week for each Box Trap Survey standard trap site (Table VII-1) and from several randomly selected tomcod trawl samples totaling about 100 fish per week (Section II) will be taken to the field laboratory alive in buckets of river water for processing to obtain stock assessment data. The M2 and C1 card types of the field data sheet will be computer generated from the SA1 laboratory stock assessment data sheet that is completed by lab personnel for samples taken from box trap standard stations and trawl biocharacteristics samples. A sample is defined as the entire catch of tomcod from one sample collection effort. A minimum of ten fish is desired for a sample; however, should samples of ten fish not be available, smaller samples may be used as the end of the weekly sampling period approaches.

Table VII-1. Atlantic Tomcod Survey Standard Box Trap Sites

River Mile	Site	Location
25	East	Irvington[1]
36	East	Croton Yacht Club
41	East	King's Marina[1]
51	East	Garrison Yacht Club[1]
51	West	West Point
56	West	Cornwall Yacht Club
71	West	Milton – Shell Oil Dock[1]

[1] New or alternate station used in 2002-2003 for the first time. If more than one trap is fished at a given location for these new or alternate standard stations, select the laboratory sample from the trap with the largest catch on the day the lab sample is taken from that location.

1.1.1 Ovaries to be used for fecundity estimates are obtained from 1 December until 15 ovaries per length group are obtained or suitable females are no longer available. Only ovaries from Atlantic tomcod in ripe, or approaching ripe condition with no evidence of egg loss should be used (see Section 2.3). These ovaries are principally obtained from box trap biocharacteristics samples and supplemented as needed from trawl catches or other box trap samples at the discretion of the Laboratory Supervisor. Individual ovaries are removed from the fish and preserved in 10% buffered formalin. The fecundity samples are processed no earlier than one month after collection.

2.0 SAMPLE PROCESSING FOR ATLANTIC TOMCOD

2.1 ATLANTIC TOMCOD LENGTH, WEIGHT, SEX AND SEXUAL CONDITION

Tomcod from box trap samples are placed in a container filled 1/4 to 1/3 full of water and may, at the discretion of the technician, have sufficient MS-222 to over-anesthetize the fish. Lab processing should occur within 6 hrs of capture. If delayed for more than 6 hrs and less than 24 hrs from time of capture, the catch should be refrigerated; if delayed more than 24 hrs from time of capture, the catch should be frozen. Fish are processed by sample, individual specimens in the sample are processed as follows:

- All fish are analyzed, and the total length (nearest mm), weight (nearest 0.1 g), sex and sexual condition for each specimen is determined.
- All tomcod must be checked for tags, tag wounds, and finclips. All recaptures and suspected recaptures are frozen in a labeled (sample ID number, and collection date) container and saved for verification. Recaptured fish are coded as REL_REC = 2 (within program) or REL_REC = 5 (from previous programs). The alive/dead status at the time of capture is assumed to be A_D = 1 (alive) unless specifically noted otherwise on the field data sheet.

2.1.1 Atlantic Tomcod Sexual Condition Criteria

LABEL	CODE	DESCRIPTION
Ripe	1	Adult in spawning condition - gonads well developed but no milt or eggs extruded upon application of pressure to gonadal area. Will spawn in current season.
Ripe and Running	2	Adult prepared to spawn immediately; expulsion of eggs or milt from body with little provocation.
Partially Spent	3	Sexual products partially discharged; gonads somewhat flaccid as opposed to the firmness of a developing gonad. Genital aperture usually inflamed, some hemorrhaging evident.
Spent	4	Applied to adult specimens at completion of spawning activity. The sexual products have been discharged - genital aperture usually inflamed and hemorrhaging present. The gonads have the appearance of deflated sacs, the ovaries usually containing a few leftover eggs in a state of reabsorption and the testes have some residual sperm. Ovarian walls will become leathery.
Immature	5	A specimen which is either male or female, but too young to spawn (sub-adult). Transparent or pinkish gonads, not developed.
Resting	6	Applies to adult fish with underdeveloped gonads.
Developing	7	Applicable to sub-ripe fish heading into spawning season. Testes are opaque and reddish to reddish white. Ovaries may appear orange and eggs visible to the naked eye, granular, and whitish to orange-reddish. May or may not spawn.
Mature	8	N/A

LABEL	CODE	DESCRIPTION
Not Examined	9	N/A

2.2 ATLANTIC TOMCOD AGE

- Tomcod ≤150 mm are considered age 1 fish and their otoliths are not examined.
- All tomcod >150 mm are aged by examining their otoliths and counting the number of margins where clear areas change to opaque.
- The otoliths are removed and placed on a dark background with a few drops of water or alcohol.
- The number of opaque rings (using reflected light) is counted and the age is determined. The otolith may be examined with or without the aid of a low power microscope depending upon the clarity of the rings.
- Alternatively, the otolith may be removed, and read wet with transmitted light. The number of translucent rings is counted and the age determined.
- Tomcod caught on or after 1 December and until the time of annual growth ring formation, are aged as the number of rings present. From the time of annual ring formation through November, the age is equal to the number of rings, opaque or translucent, less one.
- Quality control inspection is performed at the time of original age determination.
- Otolith samples inspected for QC and all samples from fish determined to be Age 3 or older are saved in scale envelopes labeled with sample number and fish ID number.

2.3 ATLANTIC TOMCOD FECUNDITY

2.3.1 Ovary Samples

Ovaries to be used for fecundity estimates are obtained from 1 December until:

- fecundity quotas are filled, or
- suitable females are no longer available.

These ovaries are principally obtained from box trap biocharacteristics samples. Ovaries from other sources (e.g. otter trawls) will be considered for fecundity purposes only if box trap catches fail to provide necessary samples. Seasonal fecundity quotas are 15 ovaries per length group (refer to Table III-3 for length group definitions). Individual ovaries are processed as follows:

- Females selected for fecundity purposes should be ripe or approaching ripe running condition and show no evidence of egg loss (i.e., reddened genital pore with or without extruded ovarian tissue - highly vascular translucent tissue).
- Length, weight, sex, sexual condition, and age are determined for each specimen from which a fecundity sample is obtained.

- Ovaries are removed by holding the female over a container and cutting the abdominal wall, using caution not to cut the ovary.
- The ovary and all loose ova are placed in a labeled (Individual Fish ID number, species code, and date of fish collection) container.
- The ovary wall is ruptured in several areas, and sufficient buffered formalin is added to cover the eggs with 1 to 1.5 in. of fluid.
- The sample is shaken several times during the first several hours to facilitate preservation.

2.3.2 Atlantic Tomcod Fecundity Estimate

The following procedures are followed to determine Atlantic tomcod gonad weights and number of eggs per gonad:

- Place sample in a fine mesh sieve and wash gently to remove preservative and ovarian tissue other than eggs.
- Scrape sample onto filter paper, place filter paper onto paper towels and allow to drain for five minutes.
- Place a clean petri dish onto a balance and tare balance to zero. This zero reading must be confirmed by a second independent party. The two must agree that the balance reads exactly zero or the procedure is repeated until agreement is reached.
- The egg mass is placed on the tared petri dish and total egg mass weighed to the nearest 0.01 g.
- The petri dish containing the egg mass is then removed from the balance and a second person immediately reweighs it. This second reading must be within ±0.02 g or ±3% of the first reading, whichever is greater.
- Percent difference is determined with the following equation:

$$\%\,Difference = \frac{Original\,Wt - QC\,Wt\;x100}{QC\,Wt}$$

- If the second reading is not within tolerance of the first, a third person repeats the weighing procedure.
- If the third reading is within tolerance of the first, use the first reading. If the third reading is within tolerance of the second, use the second reading and revise the data appropriately. If the third reading is not within tolerance of the first or second, return the entire sample to its container and reanalyze after balance has been examined for possible malfunction.
- When an acceptable gonad weight has been obtained, a second clean petri dish is placed on the balance and the balance tared to read zero. This zero reading must be confirmed by a second independent party. The two must agree that the balance reads exactly zero or the procedure is repeated until agreement is reached.

- A subsample of approximately 2 g is immediately removed from the egg mass and weighed in the second petri dish to the nearest 0.01 g.
- The petri dish containing the subsample is then removed from the balance and a second person immediately reweighs it. This second reading must be within ±0.02 g or ±3% of the first reading, whichever is greater. Percent difference calculations and corrective action steps are the same as were used for total gonad weight.
- The number of eggs in the subsample are counted and recorded. Portions of eggs judged to be 50% or more of a whole egg are counted.

2.4 FINCLIP OR VISUAL IMPLANT TAG VERIFICATION FOR ATLANTIC TOMCOD

Atlantic tomcod samples preserved for mark verification are recorded in a log as they are processed (card type MR1). Information recorded in the log includes the sample number, date of collection, initials of the individual that processed the sample, the date of processing, and the number of specimens of each species examined.

2.4.1 If suspected finclip recaptured Atlantic tomcod are taken to the lab, all specimens in a sample are carefully examined and a decision is made as to whether each fish is a recapture based on the presence of one or more clipped fins. All fish with clipped fins will be carefully examined for the presence of visual implant tags in the vicinity of the right eye, right operculum or right pectoral fin.

All questionable finclips are examined by at least two persons until agreement is reached.

The ideal finclip has a straight clean margin with all rays and spines cut. Departures from this condition are handled as follows using a binocular microscope.

If many rays are cut evenly but some are uncut, the clip is considered to be a valid (verified) clip.

If one or more fins are eroded or membranes between the rays are missing, the fin is probably diseased and is not counted as a clip.

Regenerated fins have each ray bending at a point that is in line with adjacent rays (as rays regenerate, they rarely grow back straight and may bend in any direction). A regenerated fin is counted as a valid finclip.

Often, many fins on one fish will appear regenerated, any such questionable finclip is not counted.

Fins that are partially or totally absent, but obviously not a result of clipping are considered to be anomalies or "no clips".

A missing fin is counted as a "no clip" when an injury is apparent, i.e., some flesh around it is also damaged or absent.

2.4.2 During sample processing, all fish are sorted by classification (verified recapture from the present or previous programs, visual implant tag, no clip) and the data are recorded. All fish greater than 150 mmTL are aged by otolith determination. REL_REC codes are assigned as follows:

REL_REC = 2 for verified, valid cross-gear or same gear recapture, i.e. a fish released in box traps in the current program and caught in a trawl sample from the current program or released in box traps

and caught in box traps during the current program. Be sure to record the visual implant tag number if a tag is found.

REL_REC = 5 for a verified, valid tomcod that was released during prior programs and recaptured during the current program. These fish must be Age 2 or older and (if finclipped) have an old verified clip, perhaps with some fin regeneration, or a visual implant tag color from the previous year's program. Be sure to record the visual implant tag number if a tag is found.

REL_REC = 9 for suspected cross-program, same gear or cross-gear recapture which is found to have a damaged or anomalous fin or fins and is therefore not a valid recapture. Do not fill in a MARK_CD for these fish.

REL_REC = 8 is not used.

Individual specimens are identified by their Sample and Fish ID number from the field M2 card and their otoliths saved in a labeled envelope for QC purposes.

2.4.3 All visual implant recaptured tomcod are examined to verify and record the tag color (mark code) and legend.

PRESENCE AND DEGREE OF LIVER TUMORS IN ATLANTIC TOMCOD

During the 2001-02 program we began examining Atlantic tomcod for the presence and degree of neoplasia (liver cancer) by gross external examination of the liver by looking for tumors.

2.5.1 Atlantic Tomcod Liver Tumor Classification:

CODE	DESCRIPTION
1	Normal with no visible lesions
2	Small (1-5 mm diameter) clear or light gray lesions on surface of liver
3	Larger, often multi-nodular, dark legions of varying size

2.6 9M TRAWL BIOCHARACTERISTICS SAMPLE PROCESSING

Length, weight, age, sex and sexual condition are determined for all tomcod from the weekly otter trawl biocharacteristics sample using the procedures described above in Sections 2.1 and 2.2.

2.6.1 Fecundity is not usually determined for Atlantic tomcod from otter trawl biocharacteristics samples, although these fish may, at the discretion of the laboratory supervisor, be used to fill the sample quotas (see Section 2.3).

3.0 SAMPLE HANDLING AND PRESERVATION

All fecundity samples are taken to the laboratory. Once the data for length, weight, sex, and sexual condition have been obtained and QC completed, those specimens are disposed of in an acceptable manner. Ovaries for fecundity data are preserved in buffered 10% formalin. Samples are shaken several times during the first several hours to facilitate preservation. These samples must be stored for at least one month in buffered 10% formalin before processing can begin. After analysis, the

subsample, including all ovarian tissue and eggs, is placed in a small container filled with 10% buffered formalin and labeled with date of capture and fish identification number. The subsample container is placed with the complete gonad in the original sample container and stored for QC inspection. Otolith samples inspected for QC and all samples determined to be age 3 or older are saved in labeled scale envelopes.

4.0 DATA HANDLING – LABORATORY DATA

All completed data sheets are reviewed for completeness and legibility by the person who originally entered the data. Data sheets are then transferred to the Field Operations supervisor for quality control checks.

The following data sheets are used for Laboratory Tasks:

CARD TYPE	TASK
SA1	Atlantic tomcod stock assessment(length, weight, age, sex)(Figure VII-1)
ED2	Atlantic tomcod fecundity(fecundity)(Figure VII-2)
MR2	Mark/Recapture verification (age, length, mark code) (Figure VII-3)

4.1 LABORATORY DATA SHEET CODING INSTRUCTIONS

Coding instructions for each laboratory card type are given below. Definitions for each variable and corresponding codes for each variable can be found in the Con Edison Data Dictionary. All entries should be made neatly with only one symbol per data block. The individual whose initials are entered on the data sheet is responsible for assuring the legibility of all entries.

All limiting values, tolerances, and precision limits are described in detail in the Con Edison Data Dictionary. The term "enter" appears in the data sheet coding instructions for all variables which require review of the data dictionary for appropriate codes. The term "record" indicates no further information is required in order to complete the coding. The abbreviation N/A is not applicable to this study and is not entered or recorded.

4.2 SOURCE CARD TYPE SA1

Source Card Type SA1 (Figure VII-1) is used to record stock assessment data for Atlantic tomcod.

VARIABLE NAME	INSTRUCTIONS
YEAR	Record year of sample collection
SOURCE CARD TYPE	Preprinted SA1
TASK_CD	Enter field task code from which sample originated (BOX TRAP=43 TRAWLS=53)
SAMPLE	Record field sample number from which sample originated
TAXON	Preprinted as taxon 32
INITIALS	Record employee I.D. number of person recording the data
PROC_DT	Record date (mo/day/yr) the sample was processed

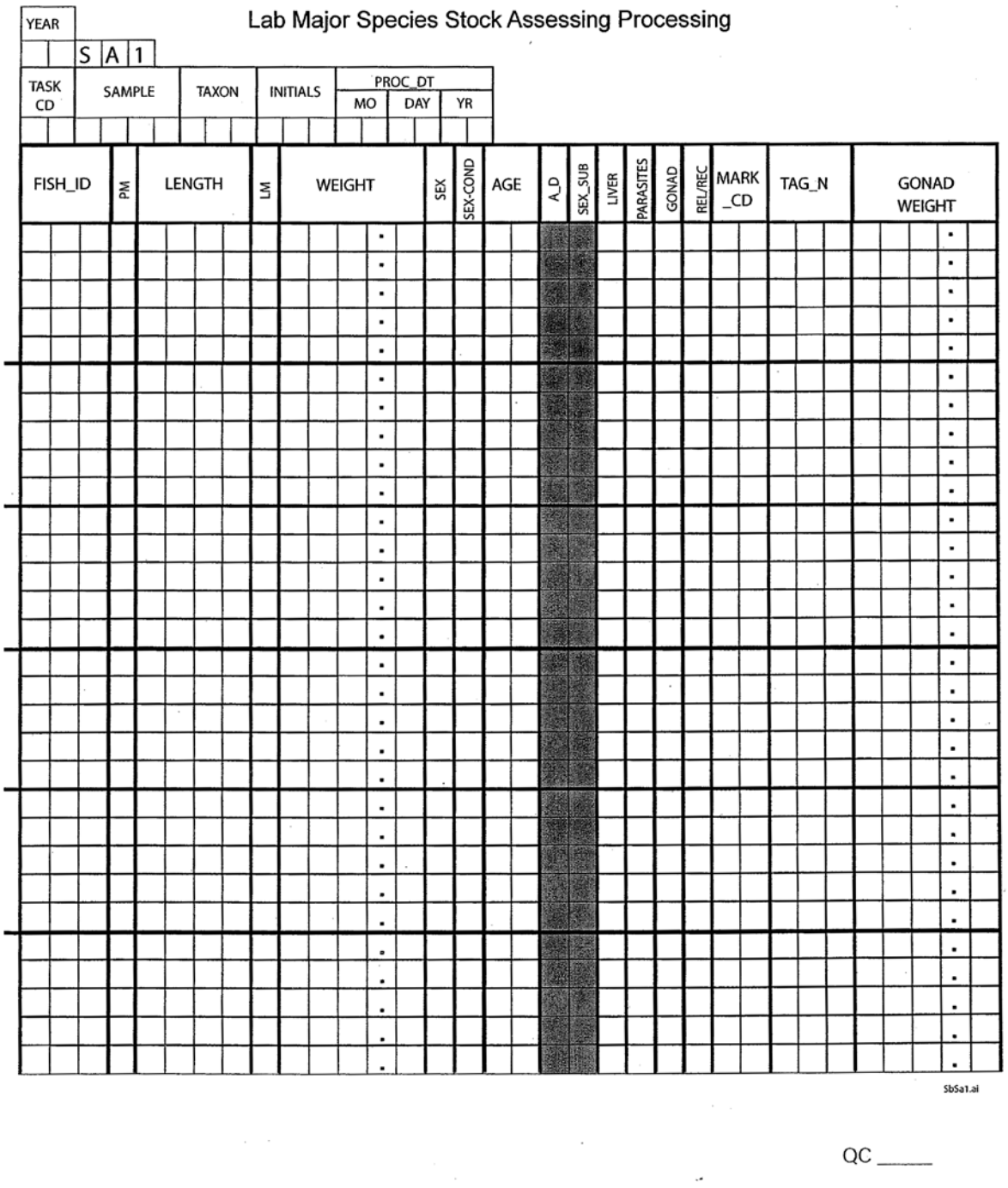


Figure VII-1. Card Type SA1 Atlantic Tomcod Stock Assessment Data Sheet for the Hudson River Atlantic Tomcod Program

VARIABLE NAME	INSTRUCTIONS
LG	N/A
N_MALES_LG1-8	N/A (determined by computer)
N_TOTAL_LG1-8	N/A (determined by computer)
FISH_ID	Record assigned identification number from M2 field card
PM	Enter appropriate code for preservation method: 1 = fresh 2 = refrigerated 3 = frozen 4 = formalin 5 = other
LENGTH	Record total length in millimeters
LM	Enter appropriate code for method of length measurement used (Prepunched as 1 for total length)
WEIGHT	Record weight in grams to the precision specified in the laboratory operations standard operating procedures
SEX	Enter appropriate code for sex: 1 = male 2 = female 3 = not examined 7 = examined but unable to identify 8 = hermaphrodite
SEX_COND	Enter appropriate code for sexual condition (Section 2.1.1)
AGE	Record age of subsampled fish
A_D	Assumed to be 1 unless the field data says otherwise
SEX-SUB	N/A
LIVER	Enter the appropriate liver tumor classification (Section 2.5.1) 1 = normal with no visible lesions 2 = small (1-5 mm diameter) clear or light gray lesions 3 = larger, often multi-nodules, dark lesions of varying size
PARASITES	Enter the appropriate code describing the degree of external parasitic infestation 2 = no external parasites observed 3 = light, 1 to 5 external parasites 4 = moderate, 6 to 20 external parasites 5 = heavy, >20 external parasites blank = not examined
GONAD	Enter code indicating availability of gonad for secondary processing:

VARIABLE NAME	INSTRUCTIONS
	1 = gonad collected for fecundity processing
	3 = gonad sample not collected
REL_REC	Enter appropriate release/recapture code
MARK_CD	Enter mark code for the type of tag or finclip used
TAG_N	Enter the appropriate visual implant tag number if the tag is present
GONAD	Record weight in grams of gonads (male and female fish)

4.3 SOURCE CARD TYPE ED2

Source card type ED2 (Figure VII-2) is used to record Atlantic tomcod fecundity data.

VARIABLE NAME	INSTRUCTIONS
YEAR	Record year of sample collection
SOURCE CARD TYPE	Preprinted ED2
TASK_CD	Enter 43 for box traps or (rarely) 53 for trawls
RIVER AREA	N/A
SAMPLE	Record sample number from which fish was taken
FISH_ID	Record fish ID number from SA1 data sheet
TAXON	ENTER 32 for Atlantic Tomcod
INITIALS	Record last three digits of employee number of person performing measurements
PROC_DT	Record date (mo/day/yr) the same was processed
GONAD_WT	Record weight of entire gonad to nearest 0.01 g
OVSUB_WT	Record weight of ovary subsample to nearest 0.01 g
EGSUB_CT	Record the number of eggs counted in the ovary subsample

4.4 SOURCE CARD TYPE MR2

Source card type MR2 (Figure VII-3) is used to verify suspected recaptured Atlantic tomcod.

VARIABLE NAME	INSTRUCTIONS
YEAR	Record year of sample collection
SOURCE CARD TYPE	Preprinted MR2
PROC_DT	Record the date (mo/day/yr) when the fish was evaluated as a possible recapture
TASK_CD	Enter 43 for Atlantic tomcod box trap survey, 53 for trawling
SAMPLE	Record field sample number from which sample originated
FISH_ID	Record assigned fish identification number from M2 field card

VARIABLE NAME	INSTRUCTIONS
REL_REC	Enter appropriate release/recapture code: 2 = same year recapture 5 = prior year recapture 9 = not a valid fin clip
MARK_CD	Enter appropriate finclip mark code for Atlantic tomcod if the fish is a valid recapture
TAXON	Preprinted taxon code = 32
LENGTH	Record the total length of each fish in millimeters
LM	Preprinted as 1 for total length
WEIGHT	Record the weight to the nearest 0.1 g
AGE	Record the age for all verified recapture fish
SEX	Enter the sex of all verified recapture fish
SEX_COND	Enter appropriate code for sexual condition (Section 2.1.1)
LG	Enter the appropriate length group (1-8) for all Atlantic tomcod
CT_CLIPS	Preprinted as 1 for the number of Atlantic tomcod recaptured with the specified MARK_CD. NOTE: This is always 1 because individual fish are assigned unique ID numbers
INITIALS	Record the employee number of person verifying possible recaptured fish
TAG_N	Enter the appropriate visual implant tag number if the tag is present
TAG_COND	Enter the code for the condition of the visual implant tag insertion site for REL_REC = 2 or 5 Atlantic tomcod: 1 = Healed tag insertion 2 = Infected tag insertion
BLIND	Enter the code for the condition of each REL_REC = 2 or 5 Atlantic tomcod with respect to blindness: 1 = blind in one eye 2 = blind in both eyes blank = not present
FUNGUS	Enter the code for the condition of each REL_REC = 2 or 5 Atlantic tomcod with respect to body fungus (lymphocystis): 1 = fungus on part or all of one side of body 2 =fungus on part or all of both sides of body blank = not present

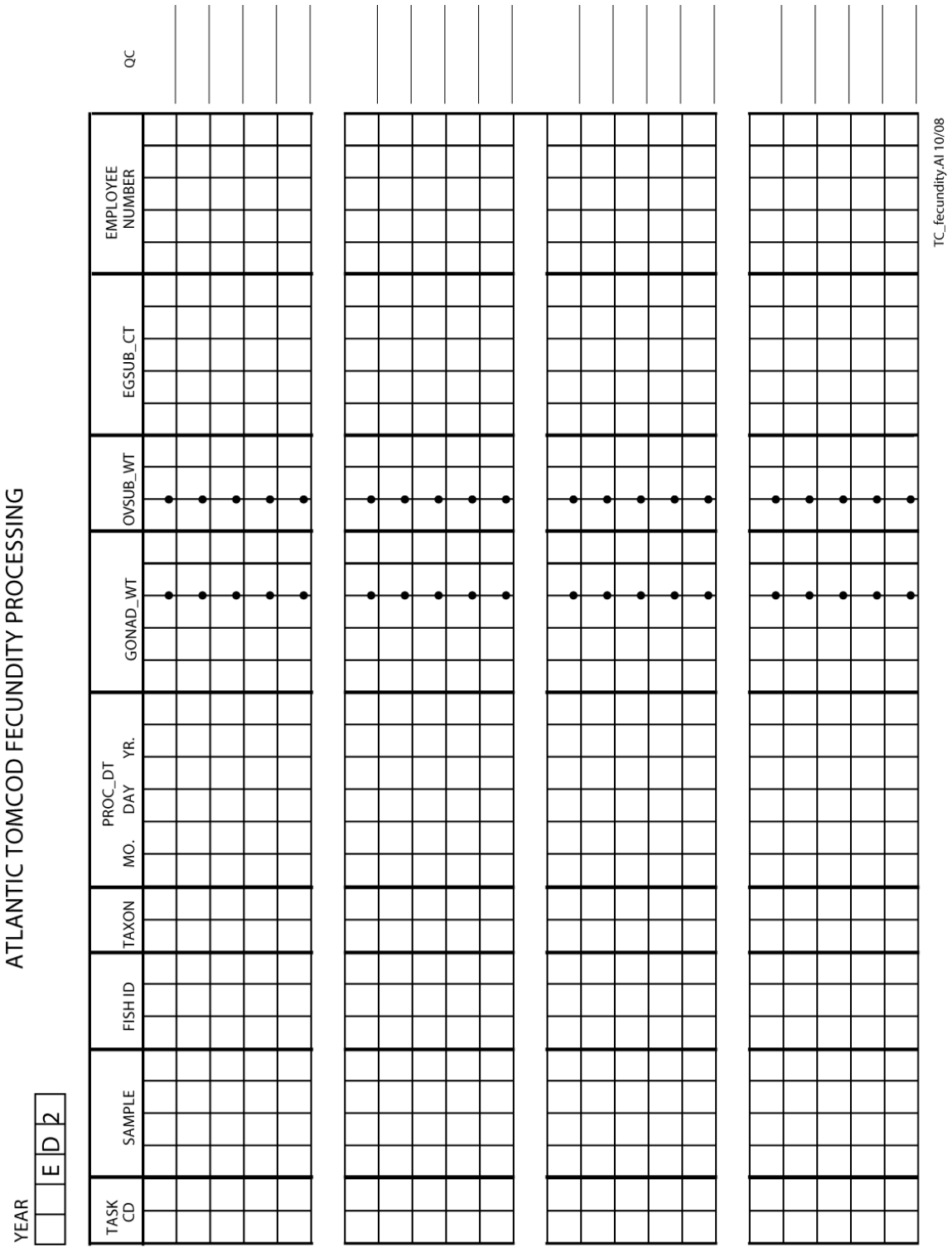


Figure VII-2. Laboratory fecundity data sheet for the Hudson River Atlantic Tomcod Program

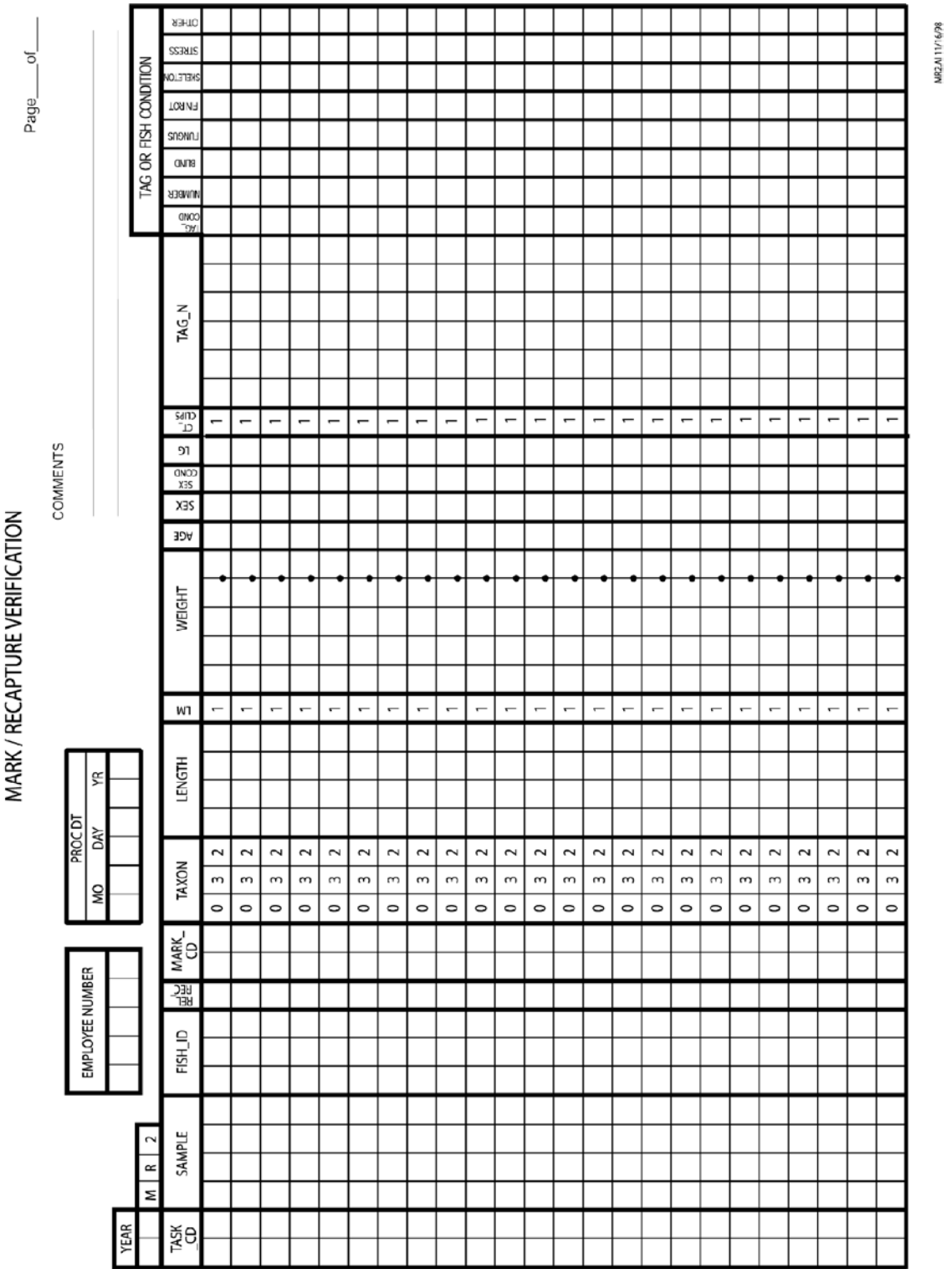


Figure VII-3. Card Type MR2, Atlantic Tomcod Survey Visual Implant Tag and Finclip Verification Data Sheet for the Hudson River Atlantic Tomcod Program

VARIABLE NAME	INSTRUCTIONS
FINROT	Enter the code for the condition of each REL_REC = 2 or 5 Atlantic tomcod with respect to fin rot: 1 = fin rot on caudal (tail) fin 2 = fin rot on pectoral fin(s) 3 = fin rot on pelvic fin(s) 4 = fin rot on anal fin 5 = fin rot on dorsal fin(s) 6 = multiple fins blank = not present
STRESS	Enter the code for the condition of each REL_REC = 2 or 5 Atlantic tomcod with respect to stress: 1 = net rash (external body abrasion) 2 = crushed or cut 3 = handling stress blank = none present
OTHER	Enter the code for the condition of each REL_REC = 2 or 5 Atlantic tomcod with respect to other observed factors relating to poor condition that are not already coded: 1 = if other injury is present, describe injury in COMMENTS

5.0 QUALITY CONTROL FOR ATLANTIC TOMCOD SAMPLE PROCESSING

The quality control plan is applied on an individual processor basis. Each processor will start each task at a 100% inspection starting level. All quality control determinations are performed by a second observer, independent from the original determination.

5.1 TOTAL LENGTH, WEIGHT, SEX AND AGE DETERMINATION QUALITY CONTROL

Total length, weight, sex and age determination data are verified following initial processing with the following quality control procedures:

- 100% of each processor's samples are reanalyzed until "i" consecutive samples are found to be within acceptable tolerance (Table VII-2).
- When "i" consecutive samples are found free of defects, a fraction "f" of the processor's samples are reanalyzed (Table VII-2). All samples to be reanalyzed are selected at random.
- Frequency "f" inspection continues and a count is kept of the number inspected. If a sample is encountered which exceeds acceptable tolerance before "i" samples have been reanalyzed, 100% inspection is reestablished and the QC plan is restarted at the beginning.

- If "i" reanalyzed samples at frequency "f" inspection are found to be within acceptable limits, inspection continues at frequency "f" until a defective sample is encountered.
- When this defective sample is encountered, the next "x" samples are reanalyzed.
- If any of these "x" samples are found defective, 100% inspection is immediately invoked and the QC plan is restarted at the beginning.
- If no defective samples are found in the "x" samples, inspection reverts back to frequency "f" inspection and a count is kept of the number inspected. If no defective samples are found in "i" reanalyzed samples inspection continues at "f".
- If, however, a second defective sample is found prior to finding "i" acceptable reanalyzed samples, 100% inspection is invoked and the QC plan is restarted at the beginning.

Table VII-2. Task Specific Application of Continuous Sampling Plan for the Atlantic Tomcod Survey.

Laboratory Task	QC Plan	i	f	x	Tolerance	QC Sample Definition
Total Length	CSP-V	21	1/15	7	±1mm when ≤34mm TL ±3% when ≥34mm TL	One fish
Weight	CSP-V	21	1/15	7	±0.1g when ≤5g ±3% when ≥5 g	One fish
Sex Determination	CSP-V	21	1/15	7	±0	One fish
Age Determination	CSP-V	21	1/15	7	±0	One fish

i = number of consecutive samples reanalyzed and found to be acceptable
f = fraction of a processor's samples which are reanalyzed following acceptance of "i" consecutive samples

5.1.1 Acceptance/Rejection Procedures

Tolerance criteria are presented in Table VII-2. Procedures for determining acceptable quality control comparisons are as follows:

- If the original and QC values are within tolerance, the original value is considered acceptable. To calculate percent difference, use the following equation:

$$\%\,Difference = \frac{Original - QC\ x100}{QC}$$

- If the original and QC values are not within tolerance, a resolution is required.

Discrepancies are resolved by a third observer, independent from all previous determinations. The only exception to this rule is that discrepancies in age determinations are resolved by the original and QC processors. If no resolution can be reached, a third person is consulted for resolution. The following procedures apply:

- If the original and resolution values are within tolerance, the original value is considered acceptable. To calculate percent difference, use the following equation:

$$\%\ Difference = \frac{Original - \text{Re}\,solution\ x100}{\text{Re}\,solution}$$

- If the original and resolution values are not within tolerance, but the resolution and QC values are within tolerance, the original value is considered unacceptable and replaced with the QC value.
- If agreement within tolerance cannot be reached, the data are voided and are not considered either pass or fail. A replacement sample is selected for inspection from the same lot.
- Data found to be unacceptable are replaced with the correct data.
- QC and resolution data are entered in a task specific log.

5.2 GONAD WEIGHT, SUBSAMPLE WEIGHT AND TARE QUALITY CONTROL

Gonad weight, subsample weight and tare determinations are 100% inspected. Inspection is performed immediately after the original determination as described in Section VII-2.3.2. Acceptable tolerances are:

Task	Tolerance	QC Sample Definition
Gonad Weight	±0.02 g when ≤1 g ±3%when >1 g	Each gonad
Subsample Weight	±0.02 g when ≤1 g ±3% when >1 g	Each subsample
Tare	±0	Each tare

Percent difference is determined using the following equation:

$$\%\ Difference = \frac{Original - Wt - QC\,Wt\ x100}{QC\,Wt}$$

5.2.1 Acceptance/Rejection Procedures

The following resolution procedures apply:

- The first and second tare readings must agree that the balance reads exactly zero or the procedure is repeated until agreement is reached.
- If the second gonad weight or subsample weight reading is not within tolerance of the first, a third person repeats the weighing procedure.
- If the third reading is within tolerance of the first, use the first weight. If the third reading is within tolerance of the second, use the second reading and revise the data appropriately. If the third reading is not within tolerance of the first or second, return the entire sample to container and reanalyze after the balance has been examined for possible malfunction.

5.3 FECUNDITY ANALYSIS QUALITY CONTROL

5.3.1 Fecundity

- Fecundity subsample counts are verified after initial processing with the following quality control procedures:
- 100% of each processor's samples are reanalyzed until 10 consecutive samples are found to be within ± 10% of the original ovary count. A sample is one ovary.
- When 10 consecutive samples are found free of defects, one sample selected at random from each set of 10 of the processor's samples is reanalyzed.
- The 1 in 10 inspection frequency continues until a sample is encountered which exceeds acceptable tolerance. When this occurs, 100% inspection is reestablished and the QC plan is restarted at the beginning.

5.3.1.1 Fecundity Acceptance/Rejection Procedures

Tolerance criteria are ± 10% difference between the original, QC or resolution counts. Procedures for determining acceptable quality control comparisons are as follows:

- If the original and QC counts are within ± 10%, the original count is considered acceptable. To calculate percent difference, utilize the following equation:

$$\%\ Difference = \frac{Original - Ct - QC\ Count\ x100}{QC\ Ct}$$

- If the original and QC counts are greater than ± 10%, a resolution is required.

Resolutions are performed by a third observer, independent from all previous determinations. The following procedures apply:

- If the original and resolution counts are within ± 10%, the original count is considered acceptable. To calculate percent difference, utilize the following equation:

$$\%\ Difference = \frac{Original - Ct - \mathrm{Re}\,solution\,Ct\ x100}{\mathrm{Re}\,solution\,Ct}$$

- If the original and resolution counts are not within ± 10%, but the resolution and QC counts are within ± 10%, the original count is considered unacceptable and replaced with the QC count.
- If agreement within ± 10% cannot be reached, the sample fails but an average of the three counts is used for data purposes.
- Data found to be unacceptable are replaced with the corrected data.
- QC and resolution data are entered in a task specific log.

5.4 ATLANTIC TOMCOD FINCLIP OR VISUAL IMPLANT TAG VERIFICATION QUALITY CONTROL

All Atlantic tomcod mark verification samples and the data presented on the MR1 card type are subjected to a 100% reinspection by the laboratory supervisor. Any discrepancies are resolved by a third independent party.

6.0 SAMPLE STORAGE

6.1 BOX TRAP SAMPLES

All box trap samples received by the field laboratory should be processed within six hours of collection. If samples cannot be processed within six hours but can be processed within 24 hours, they are refrigerated. If samples must wait greater than 24 hours, they are frozen. Once the samples have been processed, they are disposed of in a sanitary manner.

6.2 FECUNDITY SAMPLES

Fecundity samples are stored for a minimum of one month at the field laboratory until processed. After analysis the complete gonad and a small container with the subsampled portion of the gonad are placed in 10% formalin and stored at the laboratory until the final report is accepted by the client. Once the report is accepted, the fecundity samples are transferred to the Quality Assurance Department for long term storage and eventual disposal.

7.0 EQUIPMENT CALIBRATION

7.1 A&D PRECISION ELECTRONIC BALANCE

Precision and accuracy of the balance is checked annually by Normandeau's Standards Laboratory. Calibration of the balance is checked before each daily use in the following manner:

- The balance's zero is checked and adjusted if necessary.
- Weigh the 1 g, 10 g, 50 g, and 100 g class S weights.
- A record is kept of all precision and accuracy tests, daily calibration checks, maintenance and repairs including dates activity was performed and initials of individual performing activity.

If calibration check exceeds the acceptable tolerance limits (Table VII-3), troubleshoot for the cause and reweigh the Class S weights. If the problem cannot be corrected, another balance must be used that will pass the calibration check.

Table VII-3. Class S Weight Tolerance for Sartorius Balance.

Weight	Tolerance
1 g	±0.01 g
10 g	±0.01 g
50 g	±0.05 g
100 g	±0.10 g

SECTION VIII. DATA CENTER STANDARD OPERATING PROCEDURES FOR THE HUDSON RIVER STRIPED BASS AND ATLANTIC TOMCOD PROGRAMS

1.0 INTRODUCTION

The Data Center will keypunch, verify and error check all field and laboratory data collected as part of the striped bass/Atlantic tomcod program (Figure VIII-1). Error-free data files will be "mapped" to Statistical Analysis System (SAS) compatible files (Appendix I) for delivery to NYPA. Additionally, most data analyses associated with the preparation of interim and final reports will use SAS files and SAS software. The data stream and processing methods use variable names and terminology defined in the Con Edison Data Dictionary to produce data files compatible with the Con Edison Data Base Management System.

2.0 KEYPUNCH AND VERIFY

1. Field and laboratory data sheets will be duplicated by the originator.
2. Original data sheets will be sent to the data center for keypunching and subsequent placement in a project file.
3. Copies of each data sheet will be retained by the originator.
4. All data will be double keypunched using Normandeau's keypunch verification software. This software requires keypunching of an original file for each data set. The data set is then keypunched a second time and this second set is simultaneously compared with the original file. Any discrepancies between the two copies causes the keyboard to lock on the discrepancy. Discrepancies must be resolved by the entry clerk before keypunching of the second data set can proceed.

3.0 ERROR CHECKING AUDITS

1. Error checking software available on Normandeau's computer system will be used to audit raw data files and provide the following types of error resolution: **Univariate, bivariate, and multivariate**.
2. Results of each error checking audit are summarized as tabular output which identifies the type of error and its location in the raw data file.
3. Errors identified by an error checking audit must be resolved by individuals knowledgeable of the data set through comparison between the original data sheet and the raw data file.
4. Error resolutions are initialed and dated on both the original data sheet (in red pencil or ink) and on a hard copy of the raw data file.
5. SAS data mapping will not proceed until all errors are resolved and error checking audits are "error free".

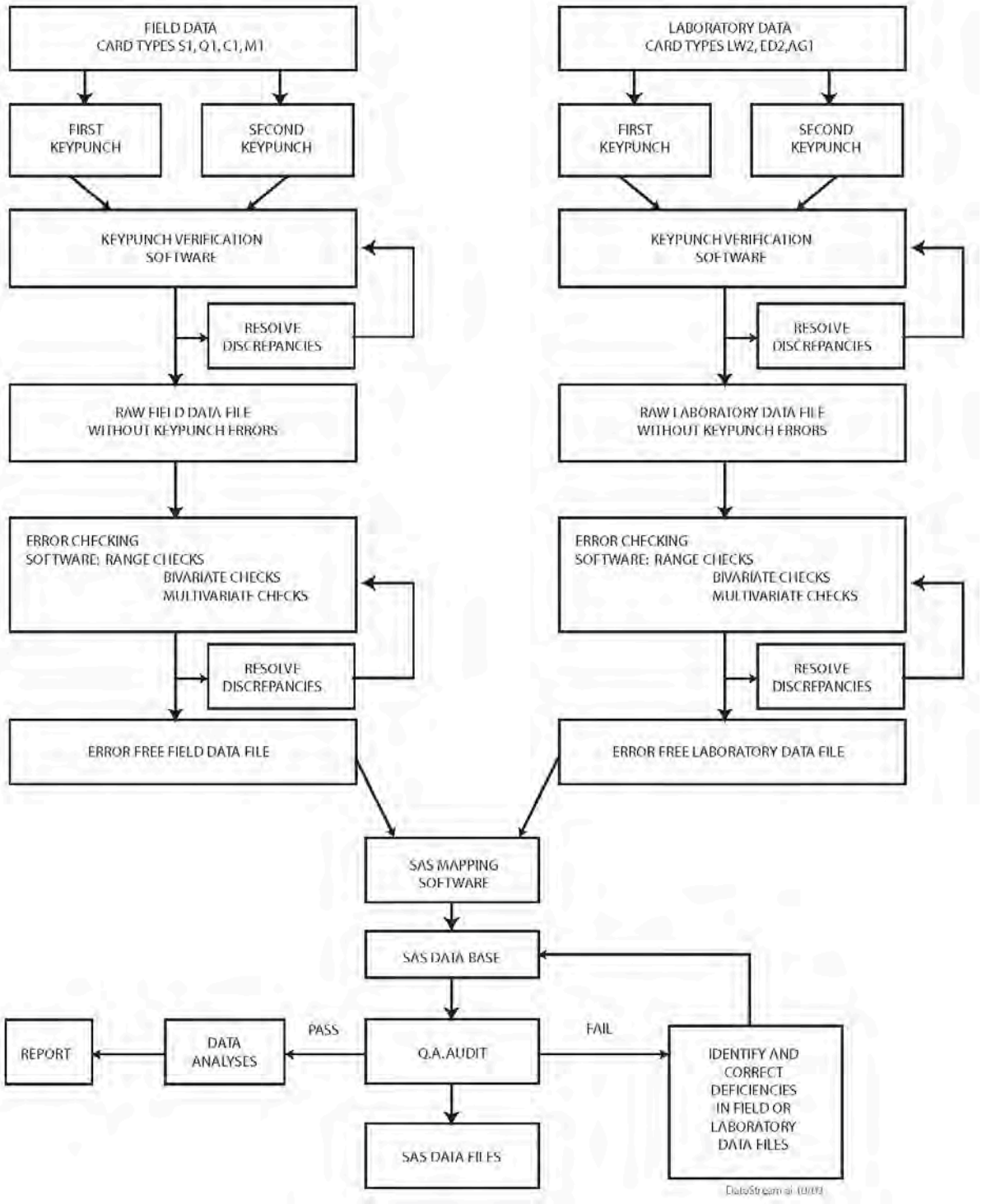


Figure VIII-1. Data stream for the Hudson River Striped Bass and Atlantic tomcod programs

3.1 The following table (Table VIII-1) summarizes the input specifications for the Error Checking Audit. SAS variable names as specified in the Con Edison Data Dictionary, the originating card type, variable values for univariate range checks, and bivariate and multivariate checks are identified. Variable values (ranges) may be respecified by project personnel following examination of each data set to account for peculiarities of the data set. The intent of this respecification is to narrowly define variable values and therefore insure a rigorous audit is conducted.

4.0 SAS MAPPING

1. SAS mapping software is used to transfer error free field and laboratory data sets into data files compatible with Con Edison's SAS Data Base as described in Appendix I.

2. Final SAS data files are audited by the Quality Assurance Department to insure that not more than one observation in one hundred is "bad" using a MIL STD-105D lot sampling plan.

3. Data analyses will not proceed until the above criteria are met.

Table VIII-1. Error Checking Audit Specifications for Card Type, Variable Names, Variable Range, and Type of Error Resolution.

Card Type	Variable (SAS)*	Values of Variable	Comparison**
S1	TASK_CD	43 or 53	U
S1	SAMPLE	0001-5000	U
S1	GEAR	36,49	U
S1	YEAR	11 or 12	U
S1	DATE MO	11,12, 1-4	U
	DAY	1-31	U
S1	TIME	2400-0001	U
S1	RIV_MILE	1-76	U,B,M
S1	SITE	4,5,or 6	U,B,M
S1	DURATION	20,15,10,5,2.5,BLANK	U,B
S1	LAT_LONG PULL	740300-735000,BLANK	U,B
		404100-711500,BLANK	U,B
	SET	740300-735000,BLANK	U,B
		404100-411500,BLANK	U,B
S1	RIV_DPTH	5-100	I,B
S1	TOW_SPD	0.5-1.5	U,B
S1	TOW DIR	1-4	U
S1	ENGINE_RPM	1000-2500	U
S1	WAVE_HT	1-4	U
S1	COILS	1,2,BLANK	U,B,M
S1	VESL_CD	15,17	U
S1	USE_CODE	1,2 or 5	U,B,M
S1	COMMENTS	1 OR BLANK	U
S1	PULL TIME	BLANK, 0001-2400	
S1	SET TIME	BLANK, 0001-2400	
Q1,Q2	H20_TEMP	5-14.9	U
Q1,Q2	COND	10-32000	U
Q1,Q2	DPTH_WQ	1-100	U,B
C1	TAXON	1-333	U

(continued)

Table VIII-1. (Continued)

Card Type	Variable (SAS)*	Values of Variable	Comparison**
C1	DIV_1	20-200	U,B
C1	DIV_2	20-200	U,B
C1	CT_LC1	0-150	U
C1	CT_LC2	0-150	U
C1	CT_LC3	0-150	U
C1	CT_LC4	0-150	U
M1	TASK_CD	53	U
M1	SAMPLE	0001-5000	U
M1	GEAR	49	U
M1	DATE	1NOV10-10APR11	U
M1	YEAR	11 or 12	U
M1	RIVER MILE	1-76	U
M1	SITE	4,5,6	U
M1	STATION	4,11,12,13,14	U
M1	LATITUDE	40	U
M1	LONGITUDE	73 OR 74	U
M1	TAXON	27 0R 29	U
M1	REL/REC	1 OR 2	U
M1	FISH ID	1-10	U
M1	LENGTH	100-1500	U
M1	WEIGHT	100-10000	U
M1	EYE WIDTH	10-100	U
M1	MOUTH WIDTH	10-100	U
M1	MOUTH RATIO	10-90	U
M1	LAT ANAL SCUTES	1OR 2	U
M1	POST DORSAL SCUTES	1 OR 2	U
M1	PRE-ANAL SCUTES	1 OR 2	U
M1	PIT TAG NUMBER	10 CHARACTERS,BLANK	U
M1	CARLIN-RITCHIE	5 CHARACTERS,BLANK	U
M1	SEX	1 OR 2, BLANK	U
M1	ALIVE DEAD	1 OR 2	U

(continued)

Table VIII-1 (Continued)

Card Type	Variable (SAS)*	Values of Variable	Comparison**
M2	TAXON	30,32	U
M2	REL_REC	1-7 or 9	U,B,M
M2	MARK_CD	90,91,96,97,98 or tomcod codes	U,B
M2	TAG_N	100,000-600,000	U,B,M
M2	LENGTH	20-1000	U,B
M2	SEX	1-3	U,B
M2	A_D	1 or 2	U,B
M2	FISH_ID	1-999	U,B
M2	CT_CLIPS	0-150, BLANK	U,B
M2	LG	1-8	U,B
M2	EFFIC	1,2, BLANK	U,B
M2	TAG_COND	1,2, BLANK	U,B,M
M2	TAG_NUM	1-4, BLANK	U,B,M
M2	TAG_ADD	1-4, BLANK	U,B,M
M2	TAG_REWD	1-4, BLANK	U,B,M
M2	TAG_ORNT	1,2, BLANK	U,B,M
M2	TAG_PROT	1,2, BLANK	U,B,M
M2	BLIND	1,2, BLANK	U,B,M
M2	FUNGUS	1,2, BLANK	U,B,M
M2	FINROT	1-6, BLANK	U,B,M
M2	SKELETON	1-3, BLANK	U,B,M
M2	STRESS	1-3, BLANK	U,B,M
M2	OTHER	1, BLANK	U,B,M
LW2	YEAR	11 or 12	U
LW2	TASK_CD	43 or 53	U
LW2	COLL_WK MO	1-4, 11, 12	U,B
LW2	DAY	1-31	
LW2	PROC_DT MO	1-6, 11, 12	U,B
LW2	DAY	1-31	I,B
LW2	YR	11 or 12	U,B
LW2	SAMPLE	1-5000	U,B,M

(continued)

Table VIII-1 (Continued)

Card Type	Variable (SAS)*		Values of Variable	Comparison**
LW2	FISH_ID		1-999	U,B,M
LW2	LENGTH		300-1500	U,B
LW2	WEIGHT		300-15000	U,B
LW2	PM		1	U
LW2	SEX		1 or 2	U,B,M
LW2	SEX_COND		1-7	U,B,M
LW2	GONAD		1 or 3	U,B
LW2	GONAD_WT		200.0-2000.0	U,B
ED2	YEAR		11 or 12	U
ED2	TASK_CD		43 or 53	U
ED2	SAMPLE		1-1500	U,B,M
ED2	FISH_ID		1-999	U,B,M
ED2	TAXON		30,32	U
ED2	INITIALS		not checked	U
ED2	PROC_DT	MO	1-6	U,B
ED2	DAY		1-31	U,B
ED2	YR		05	U,B
ED2	GONAD_WT		200.0-2000.0	U,B
ED2	OUSUB_WT		0.5-5.0	U,B
ED2	EGSUB_CT		500-5000	U,B
FH1	TASK_CD		53	U
FH1	SAMPLE		1-5000	U
FH1	NO_FISH		1-999	U
FH1	EMP_NUMB		Not checked	U,B
FH1	PROC_DT	MO	1-6, 11, 12	U,B
	DAY		1-31	U,B
	YR		11 or 12	U,B
FH1	FISH_ID		1-999	U,B,M
FH1	LENGTH		300-1500	U,B,M
FH1	VERT_INV		1,0	U,B,M

(continued)

Table VIII-1 (Continued)

Card Type	Variable (SAS)*	Values of Variable	Comparison**
FH1	PISCIV	1,0	U,B,M
FH1	TOMCOD	1,0	U,B,M
MR5	YEAR	11 or 12	U,B
MR5	TAXON	30	U
MR5	TASK_CD	53	U
MR5	SAMPLE	1-5000	U,B,M
MR5	FISH_ID	1-999	U,B
MR5	LENGTH	300-1500	U,B
MR5	REL_REC	5	U,B
MR5	MARK_CD	82, 95-98	U,B
MR5	TAG_N	100,000-600,000	U,B
MR5	TAG_COND	1,2	U,B
MR5	ANCHOR	1,2, BLANK	U,B
MR5	STREAMER	1,2, BLANK	U
MR5	TAG_SHED	1,2, BLANK	U
AG1	YEAR	11 or 12	U
AG1	TASK_CD	53	U
AG1	RIVER AREA	BLANK	U
AG1	SAMPLE	0001-5000	U
AG1	FISH ID	1-800	U
AG1	TAXON	30	U
AG1	INITIALS	NOT CHECKED	U
AG1	MONTH	1-12	U
AG1	DAY	1-31	U
AG1	YEAR	11 or 12	U
AG1	LENGTH	20-1000	U
AG1	WEIGHT	BLANK	U
AG1	AGE	0-20	U
AG1	SCALE RADIUS	35-200	U
AG1	AN1	20-90	U

(continued)

Table VIII-1 (Continued)

Card Type	Variable (SAS)*	Values of Variable	Comparison**
AG1	AN2	70-150	U
AG1	AN3	100-210	U
AG1	AN4	150-225	U
AG1	AN5	200-250	U
AG1	AN6-AN20	BLANK	U

*Variable names (as specified in Con Edison Data Dictionary, where applicable)
**U = univariate (range) check
B = bivariate check
M = multivariate check

APPENDIX 1

Proc Contents Of SAS Data Files

Striped Bass

SB09 FISH

SB09 SAMP

SB09 LAB

Atlantic Tomcod

TC09 FISH

TC09 SAMP

TC09 LAB

Alphabetic List of Variables and Attributes
Striped Bass Fish File

Variable Name	Variable Type	Variable Length	
AGE	Num	8	
AN1	Num	8	
AN2	Num	8	
AN3	Num	8	
AN4	Num	8	
AN5	Num	8	
AN6	Num	8	
AN7	Num	8	
AN8	Num	8	
AN9	Num	8	
AN10	Num	8	
AN11	Num	8	
AN12	Num	8	
AN13	Num	8	
AN14	Num	8	
AN15	Num	8	
AN16	Num	8	
AN17	Num	8	
AN18	Num	8	
AN19	Num	8	
AN20	Num	8	
A_D	Num	8	
BLIND	Num	8	
COMMENTS	Num	8	
DATE	Num	8	MMDDYY8.
DPTH_RIV	Num	8	
DURATION	Num	8	
FINROT	Num	8	
FISH_ID	Num	8	
FUNGUS	Num	8	
GEAR	Num	8	
LENGTH	Num	8	
MARK_CD	Num	8	
OTHER	Num	8	
PSITES	Num	8	
REL_REC	Num	8	
RIV_DPTH	Num	8	5.1
RIV_MILE	Num	8	
SAMPLE	Num	8	
SEX	Num	8	
SITE	Num	8	
SKELETON	Num	8	
SR	Num	8	
SS_NAR	Num	8	
STATION	Num	8	
STRESS	Num	8	
TAG_ADD	Num	8	
TAG_COND	Num	8	
TAG_N	Char	6	
TAG_NUM	Num	8	

Alphabetic List of Variables and Attributes
Striped Bass Fish File

Variable Name	Variable Type	Variable Length	
TAG_ORNT	Num	8	
TAG_PROT	Num	8	
TAG_REWD	Num	8	
TASK_CD	Num	8	
TAXON	Num	8	
TIME	Num	8	HHMM5.
USE_CODE	Num	8	
WEEK	Num	8	

Alphabetic List of Variables and Attributes
Striped Bass **Sample** File

Variable Name	Variable Type	Variable Length	
BOT_COND	Num	8	
BOT_DPTH	Num	8	
BOT_TEMP	Num	8	
COMMENTS	Num	8	
CT_LC1	Num	8	
CT_LC2	Num	8	
CT_LC3	Num	8	
CT_LC4	Num	8	
DATE	Num	8	MMDDYY8.
DIV_1	Num	8	
DIV_2	Num	8	
DPTH_RIV	Num	8	
DURATION	Num	8	
GEAR	Num	8	
REF	Num	8	
RIV_DPTH	Num	8	5.1
RIV_MILE	Num	8	
SAMPLE	Num	8	
SITE	Num	8	
STATION	Num	8	
SUR_COND	Num	8	
SUR_TEMP	Num	8	
TASK_CD	Num	8	
TAXON	Num	8	
TIME	Num	8	HHMM5.
TOTAL_CT	Num	8	
TOW_DIR	Num	8	
USE_CODE	Num	8	
WAVE_HT	Num	8	
WEEK	Num	8	

Alphabetic List of Variables and Attributes
Striped Bass **Lab** File

Variable Name	Variable Type	Variable Length	
A_D	Num	8	
COLL_DT	Num	8	MMDDYY8.
DATE	Num	8	MMDDYY8.
EMP_NUM	Num	8	
FISH_ID	Num	8	
GONAD	Num	8	
INVERTS	Num	8	
LENGTH	Num	8	
PAGE	Num	8	
PISCIV	Num	8	
PM	Num	8	
PROC_DT	Num	8	MMDDYY8.
REF	Num	8	
REL_REC	Num	8	
RIV_MILE	Num	8	
SAMPLE	Num	8	
SEX	Num	8	
SEX_COND	Num	8	
STATION	Num	8	
TASK_CD	Num	8	
TAXON	Num	8	
TOMCOD	Num	8	
VERTS	Num	8	
WEEK	Num	8	
WEIGHT	Num	8	
YEAR	Num	8	

Alphabetic List of Variables and Attributes
Atlantic Tomcod Fish File

Variable Name	Variable Type	Variable Length		
AGE	Num	8		
A_D	Num	8		
BOT_COND	Num	8		
BOT_DPTH	Num	8		
BOT_TEMP	Num	8		
COMMENTS	Num	8		
CT_CLIPS	Num	8		CT_CLIPS
CT_LC1	Num	8		
CT_LC2	Num	8		
CT_LC3	Num	8		
CT_LC4	Num	8		
CT_LG1	Num	8		
CT_LG2	Num	8		
CT_LG3	Num	8		
CT_LG4	Num	8		
CT_LG5	Num	8		
CT_LG6	Num	8		
CT_LG7	Num	8		
CT_LG8	Num	8		
DATE	Num	8	MMDDYY8.	
DIV_1	Num	8		
DIV_2	Num	8		
DPTH_RIV	Num	8		
DURATION	Num	8		
FISH_ID	Num	8		FISH_ID
FLD_STA	Num	8		
GEAR	Num	8		
LENGTH	Num	8		
LG	Num	8		
MARK_CD	Num	8		
REL_REC	Num	8		
RIV_DPTH	Num	8		
RIV_MILE	Num	8		
SAMPLE	Num	8		SAMPLE
SEX	Num	8		
SEX_COND	Num	8		
SITE	Num	8		
STATION	Num	8		
SUR_COND	Num	8		
SUR_TEMP	Num	8		
TAG_N	Char	3		
TASK_CD	Num	8		TASK_CD
TAXON	Num	8		
TIME	Num	8	HHMM5.	
TOW_DIR	Num	8		
USE_CODE	Num	8		
WAVE_HT	Num	8		
WEEK	Num	8		
YEAR	Num	8		

Alphabetic List of Variables and Attributes
Atlantic Tomcod **Sample** File

Variable Name	Variable Type	Variable Length		
BOT_COND	Num	8		
BOT_DPTH	Num	8		
BOT_TEMP	Num	8		
COMMENTS	Num	8		
CT_CLIPS	Num	8		CT_CLIPS
CT_LC1	Num	8		
CT_LC2	Num	8		
CT_LC3	Num	8		
CT_LC4	Num	8		
CT_LG1	Num	8		
CT_LG2	Num	8		
CT_LG3	Num	8		
CT_LG4	Num	8		
CT_LG5	Num	8		
CT_LG6	Num	8		
CT_LG7	Num	8		
CT_LG8	Num	8		
DATE	Num	8	MMDDYY8.	
DIV_1	Num	8		
DIV_2	Num	8		
DPTH_RIV	Num	8		
DURATION	Num	8		
FLD_STA	Num	8		
GEAR	Num	8		
RIV_DPTH	Num	8		
RIV_MILE	Num	8		
SAMPLE	Num	8		SAMPLE
SITE	Num	8		
STATION	Num	8		
SUR_COND	Num	8		
SUR_TEMP	Num	8		
TASK_CD	Num	8		TASK_CD
TAXON	Num	8		
TIME	Num	8	HHMM5.	
TOTAL_CT	Num	8		
TOW_DIR	Num	8		
USE_CODE	Num	8		
WAVE_HT	Num	8		
WEEK	Num	8		
YEAR	Num	8		

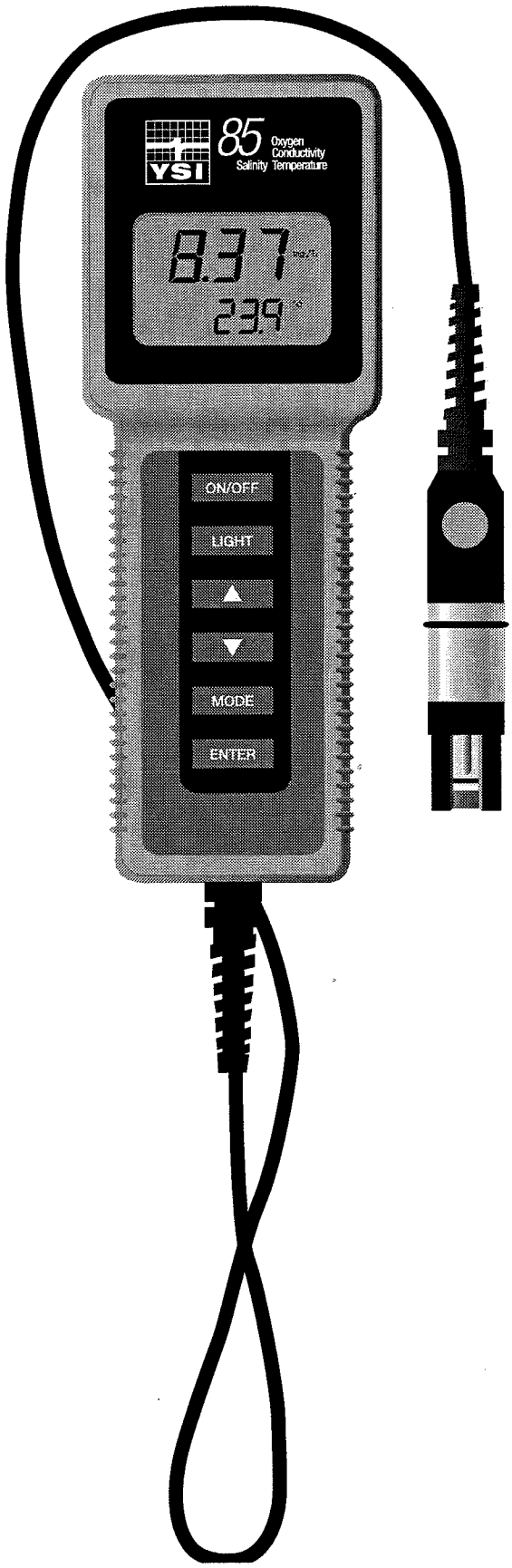
Alphabetic List of Variables and Attributes
Atlantic Tomcod **Sample** File

Variable Name	Variable Type	Variable Length		
AGE	Num	8		
BOT_COND	Num	8		
BOT_TEMP	Num	8		
DATE	Num	8	MMDDYY8.	
DURATION	Num	8		
EGSUB_CT	Num	8		
FISH_ID	Num	8		
GEAR	Num	8		
GONAD	Num	8		
GONAD_WT	Num	8		
LENGTH	Num	8		
LIVER	Num	8		
LM	Num	8		
MARK_CD	Num	8		
OVSUB_WT	Num	8		
PARASITE	Num	8		
REF	Num	8		
REL_REC	Num	8		
RIV_MILE	Num	8		
SAMPLE	Num	8		SAMPLE
SEX	Num	8		
SEX_COND	Num	8		
SITE	Num	8		
STATION	Num	8		
SUR_COND	Num	8		
SUR_TEMP	Num	8		
TAG_N	Char	3		
TASK_CD	Num	8		TASK_CD
TAXON	Num	8		
TIME	Num	8	HHMM5.	
USE_CODE	Num	8		
WEEK	Num	8		
WEIGHT	Num	8		

APPENDIX 2

YSI Model 85 Operations Manual

YSI *incorporated*



YSI Model 85

Handheld Oxygen, Conductivity, Salinity, and Temperature System

Operations Manual

CONTENTS

SECTION 1 INTRODUCTION

The YSI Model 85 Handheld Dissolved Oxygen, Conductivity, Salinity and Temperature System is a rugged, micro-processor based, digital meter with an attached YSI combination conductivity and dissolved oxygen probe.

The YSI Model 85 is designed for use in field, lab, and process control applications as well as for environmental, aquaculture, and industrial uses. The Model 85 is available with cable lengths of either 10, 25, 50 or 100 feet. The body of the probe has been manufactured with stainless steel to add rugged durability and sinking weight. The probe also utilizes our easy to install cap membranes for measuring dissolved oxygen.

The YSI Model 85 probe is a non-detachable, combination sensor designed specifically for the YSI Model 85 Handheld System. The conductivity portion is a four-electrode cell with a cell constant of 5.0/cm ±4%. The dissolved oxygen portion is a polargraphic Clark type sensor.

The Model 85's microprocessor allows the system to be easily calibrated for dissolved oxygen or conductivity with the press of a few buttons. Additionally, the microprocessor performs a self-diagnostic routine each time the instrument is turned on. The self-diagnostic routine provides you with useful information about the conductivity cell constant and function of the instrument circuitry.
The system simultaneously displays temperature (in °C), along with one of the following parameters: dissolved oxygen in either mg/L (milligrams per liter) or % air saturation; conductivity; temperature compensated conductivity; (in µS/cm or mS/cm), and salinity (in parts per thousand {ppt}).

The system requires only a single calibration regardless of which dissolved oxygen display you use. The calibration of conductivity is not required but is available. A single calibration will adjust the instrument, regardless if you are reading conductivity or temperature compensated conductivity. You can switch between all of these parameters with the push of a single key.

A calibration\storage chamber is built into the instrument case. A small sponge in the chamber can be moistened to provide a water saturated air environment that is ideal for air calibration of the dissolved oxygen probe. This chamber also provides a convenient place to store the probe when the system is not in use, and provides protection for the electrodes within the conductivity probe. The Model 85 case is also waterproof (rated to IP65). You can operate your Model 85 in the rain without damage to the instrument.

Six AA-size alkaline batteries power the instrument. A new set of alkaline batteries will provide approximately 100 hours of continuous operation. When batteries need to be replaced, the LCD will display a **"LO BAT"** message.

SECTION 2 PREPARING THE METER

2.1 UNPACKING

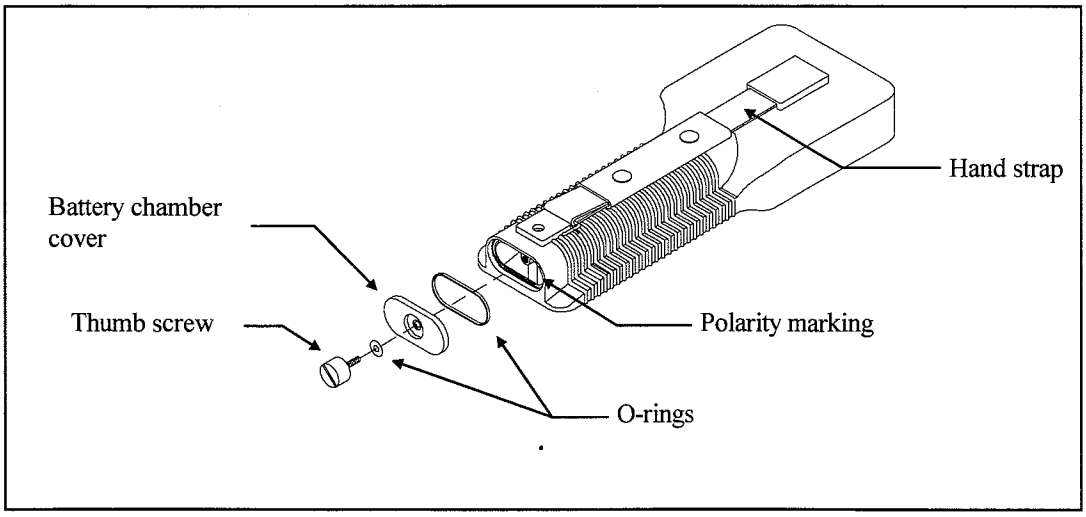
When you unpack your new YSI Model 85 Handheld Dissolved Oxygen, Conductivity, Salinity and Temperature System for the first time, check the packing list to make sure you have received everything you should have. If there is anything missing or damaged, call the dealer from whom you purchased the Model 85. If you do not know which of our authorized dealers sold the system to you, call YSI Customer Service at 800-765-4974 or 937-767-7241, and we'll be happy to help you.

2.2 WARRANTY CARD

Before you do anything else, please complete the Warranty Card and return it to YSI. This will record your purchase of this quality instrument in our computer system. Once your purchase is recorded, you will receive prompt, efficient service in the event any part of your YSI Model 85 should ever need repair and we will be able to quickly verify the warranty period.

2.3 BATTERIES

There are a few things you must do to prepare your YSI Model 85 for use. First, locate the six AA-size alkaline batteries that were included in your purchase. Use a screwdriver or a small coin to remove the thumbscrew on the bottom of the instrument. This thumbscrew holds the battery-chamber cover in place. The battery-chamber cover is marked with the words "OPEN" and "CLOSE."



NOTE: On some models, the battery cover thumbscrew may be unscrewed by hand (a screwdriver may not be required).

There is a small label inside each of the two battery-chamber sleeves. These labels illustrate the correct way to install the batteries into each sleeve of the battery-chamber.

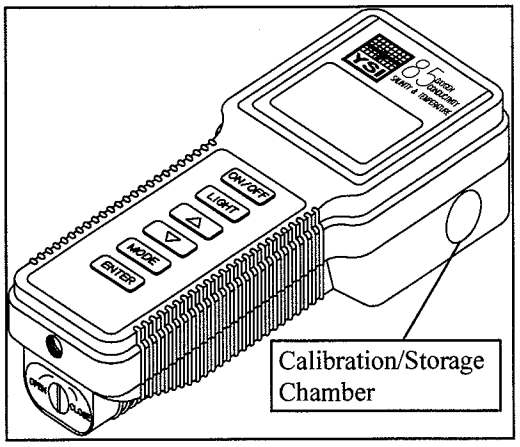
NOTE: It is very important that the batteries be installed ONLY as illustrated. The instrument will not function and may be damaged if the batteries are installed incorrectly.

Turn the instrument on by pressing and releasing the **ON/OFF** button on the front of the instrument. The liquid crystal display (LCD) should come on. Allow a few seconds for the instrument to complete its diagnostic routine. Notice that the instrument will display the specific cell constant of the conductivity probe during this diagnostic routine. If the instrument does not operate, consult the section entitled Troubleshooting.

You may also want to take the instrument into a dark room and with the instrument ON, hold down the **LIGHT** button. The instrument backlight should illuminate the LCD so that the display can be easily read.

2.4 CALIBRATION/STORAGE CHAMBER

The Model 85 has a convenient calibration storage chamber built into the instruments' side. This chamber provides an ideal storage area for the probe during transport and extended non-use. If you look into the chamber you should notice a small round sponge in the bottom of the chamber. Carefully put 3 to 6 drops of clean water into the sponge. Turn the instrument over and allow any excess water to drain out of the chamber. The wet sponge creates a 100% water saturated air environment for the probe, which is ideal for dissolved oxygen calibration.



2.5 HAND STRAP

The hand strap is designed to allow comfortable operation of the Model 85 with minimum effort. If the hand strap is adjusted correctly, it is unlikely that the instrument will be easily dropped or bumped from your hand. See figure on previous page.

To adjust the hand strap on the back of the meter, unsnap the vinyl cover and pull the two Velcro strips apart. Place your hand between the meter and the strap and adjust the strap length so that your hand is snugly held in place. Press the two Velcro strips back together and snap the vinyl cover back into place.

2.6 THE METER CASE

The meter case is sealed at the factory and is not intended to be opened, except by authorized service technicians. Do not attempt to separate the two halves of the meter case as this may damage the instrument, break the waterproof seal, and will void the manufacturer's warranty.

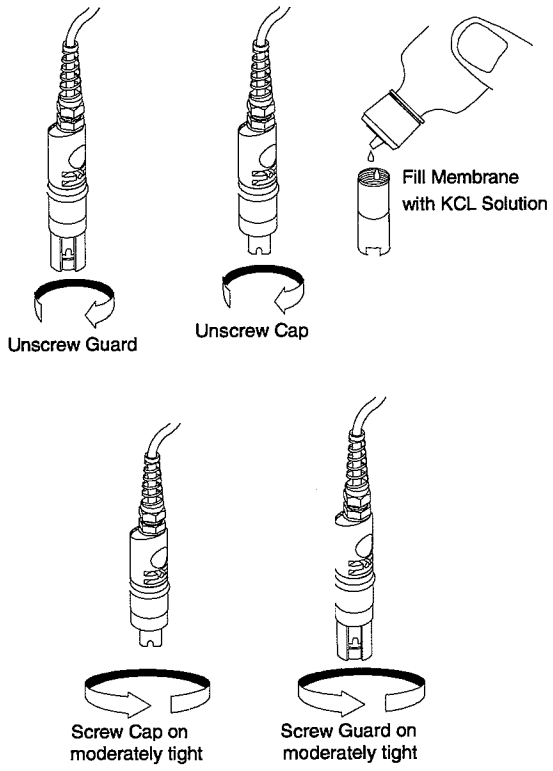
SECTION 3 PREPARING THE PROBE

The YSI Model 85 dissolved oxygen probe is shipped dry. The protective membrane cap on the probe tip must be removed and replaced with KCl solution and a new membrane cap before using the probe. Follow the instructions below to install KCl solution and the new membrane cap.

3.1 MEMBRANE CAP INSTALLATION

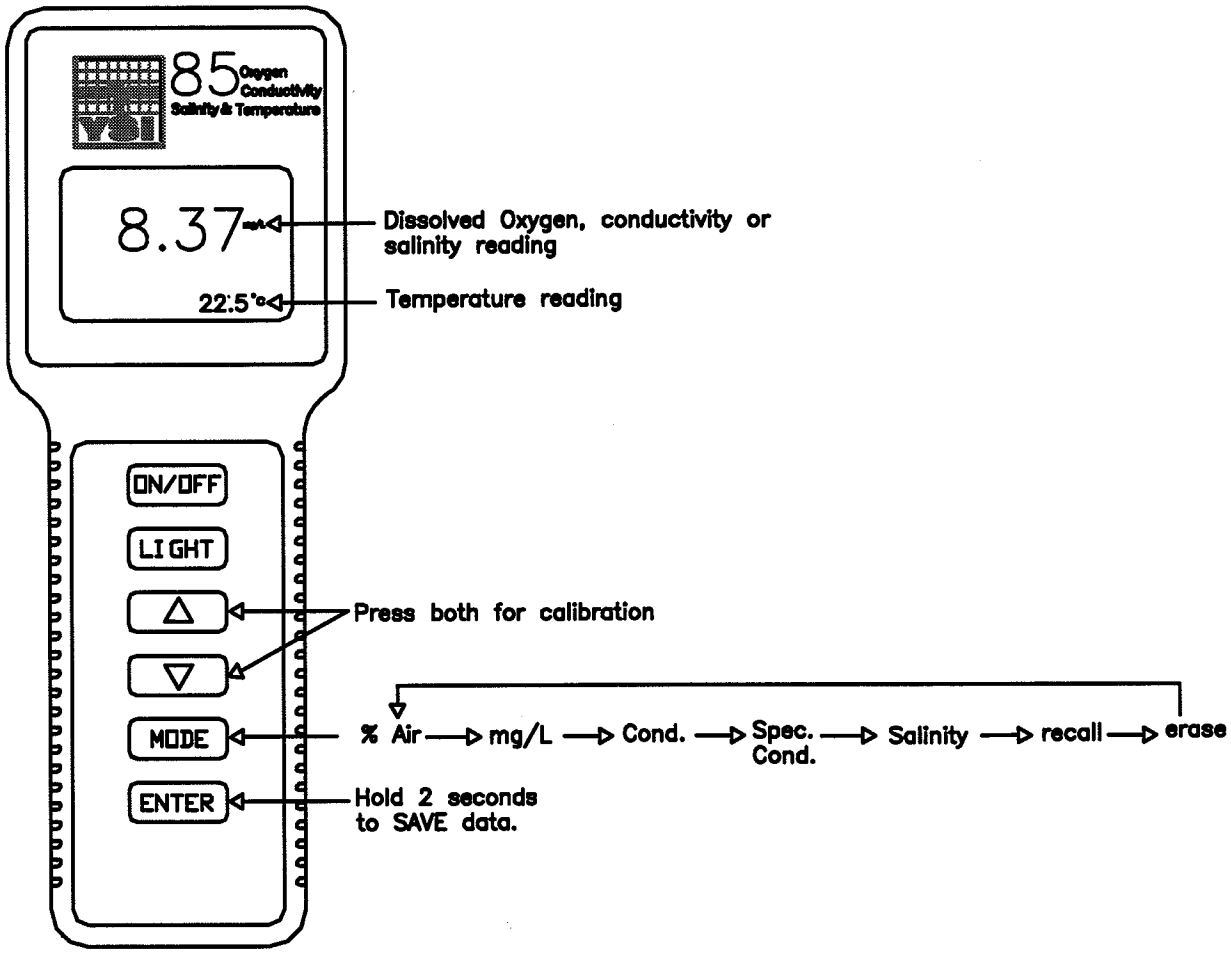
To install a new membrane on your YSI Model 85 dissolved oxygen probe:

1. Unscrew and remove the probe sensor guard.
2. Unscrew and remove the old membrane cap.
3. Thoroughly rinse the sensor tip with distilled water.
4. Prepare the electrolyte according to the directions on the KCl solution bottle.
5. Hold the membrane cap and fill it at least 1/2 full with the electrolyte solution.
6. Screw the membrane cap onto the probe moderately tight. A small amount of electrolyte should overflow.
7. Screw the probe sensor guard on moderately tight.



SECTION 4 OVERVIEW OF OPERATION

The following diagram is an overview of the operation of the Model 85. See the following sections for details of operation.

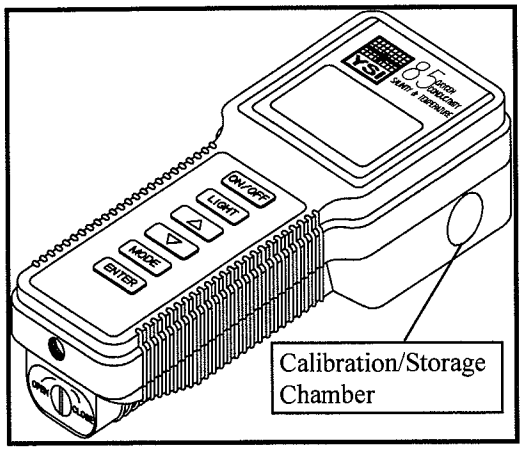


SECTION 5 CALIBRATION

5.1 CALIBRATION OF DISSOLVED OXYGEN

To accurately calibrate the YSI Model 85 you will need to know the approximate altitude of the region in which you are located.

1. Ensure that the sponge inside the instrument's calibration chamber is wet. Insert the probe into the calibration chamber.



2. Turn the instrument on by pressing the **ON/OFF** button on the front of the instrument. Press the **MODE** button until dissolved oxygen is displayed in mg/L or %. Wait for the dissolved oxygen and temperature readings to stabilize (usually 15 minutes is required).

3. Use two fingers to press and release both the **UP ARROW** and **DOWN ARROW** buttons at the same time.

4. The LCD will prompt you to enter the local altitude in hundreds of feet. Use the arrow keys to increase or decrease the altitude. When the proper altitude appears on the LCD, press the **ENTER** button once.

EXAMPLE: Entering the number 12 here indicates 1200 feet.

5. The Model 85 should now display **CAL** in the lower left of the display, the calibration value should be displayed in the lower right of the display and the current % reading (before calibration) should be on the main display. Make sure that the current % reading (large display) is stable, then press the **ENTER** button. The display should read **SAVE** then should return to the Normal Operation Mode.

Each time the Model 85 is turned off, it may be necessary to re-calibrate before taking measurements. All calibrations should be completed at a temperature which is as close as possible to the sample temperature. Dissolved oxygen readings are only as good as the calibration.

5.2 CALIBRATION OF CONDUCTIVITY

IMPORTANT: System calibration is rarely required because of the factory calibration of the YSI Model 85. However, from time to time it is wise to check the system calibration and make adjustments when necessary.

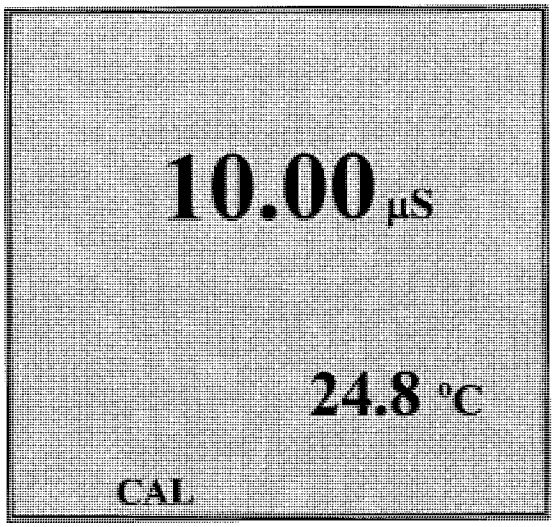
Prior to calibration of the YSI Model 85, it is important to remember the following:

1. Always use clean, properly stored, NIST traceable calibration solutions (see Accessories and Replacement Parts). When filling a calibration container prior to performing the calibration procedures, make certain that the level of calibrant buffers is high enough in the container to cover the entire probe. Gently agitate the probe to remove any bubbles in the conductivity cell.
2. Rinse the probe with distilled water (and wipe dry) between changes of calibration solutions.
3. During calibration, allow the probe time to stabilize with regard to temperature (approximately 60 seconds) before proceeding with the calibration process. The readings after calibration are only as good as the calibration itself.
4. Perform sensor calibration at a temperature as close to 25°C as possible. This will minimize any temperature compensation error.

Follow these steps to perform an accurate calibration of the YSI Model 85:

1. Turn the instrument on and allow it to complete its self-test procedure.
2. Select a calibration solution that is most similar to the sample you will be measuring.
    - For sea water choose a 50 mS/cm conductivity standard (YSI Catalog# 3169)
    - For fresh water choose a 1 mS/cm conductivity standard (YSI Catalog# 3167)
    - For brackish water choose a 10 mS/cm conductivity standard (YSI Catalog # 3168)
3. Place at least 3 inches of solution in a clean glass beaker.
4. Use the **MODE** button to advance the instrument to display conductivity.
5. Insert the probe into the beaker deep enough so that the oval-shaped hole on the side of the probe is completely covered. Do not rest the probe on the bottom of the container -- suspend it above the bottom at least 1/4 inch.
6. Allow at least 60 seconds for the temperature reading to become stable.
7. Move the probe vigorously from side to side to dislodge any air bubbles from the electrodes.
8. Press and release the **UP ARROW** and **DOWN ARROW** buttons at the same time.

The **CAL** symbol will appear at the bottom left of the display to indicate that the instrument is now in Calibration mode.



9. Use the **UP ARROW** or **DOWN ARROW** button to adjust the reading on the display until it matches the value of the calibration solution you are using.
10. Once the display reads the exact value of the calibration solution being used (the instrument will make the appropriate compensation for temperature variation from 25°C), press the **ENTER** button once. The word **"SAVE"** will flash across the display for a second indicating that the calibration has been accepted.

The YSI Model 85 is designed to retain its last conductivity calibration permanently. Therefore, there is no need to calibrate the instrument after battery changes or power down.

SECTION 6 ADVANCED CONDUCTIVITY SETUP

The default settings of the YSI Model 85 are appropriate for the vast majority of measurement applications. However, some measurement applications require very specific measurement criteria. For that reason, we have made the YSI Model 85 flexible to accommodate these "advanced users."

If, for example, you are using the YSI Model 85 for a process control application that requires that the conductivity readings be compensated to 20 °C instead of 25 °C -- this is the section to read. Or, if your application for the YSI Model 85 involves the measurement of a very specific saline solution, the default temperature coefficient may need to be changed to get the very best measurement of that specific salt.

IMPORTANT: There is never a need to enter Advanced Setup Mode unless your special measurement application calls for a change in reference temperature and or temperature coefficient. Therefore, unless you are certain that your application requires a change to one or both of these criteria, do not modify the default reference temperature (25°C) or the default temperature coefficient (1.91%).

6.1 CHANGING THE TEMPERATURE COEFFICIENT

Follow these steps to modify the temperature coefficient of the Model 85.

1. Turn the instrument on and wait for it to complete its self-test procedure.
2. Use the **MODE** button to advance the instrument to display conductivity.
3. Press and release both the **DOWN ARROW** and the **MODE** buttons at the same time.

The **CAL** symbol will appear at the bottom left of the display. The large portion of the display will show **1.91 %** (or a value set previously using Advanced Setup).

4. Use the **UP ARROW** or **DOWN ARROW** button to change the value to the desired new temperature coefficient.
5. Press the **ENTER** button. The word "**SAVE**" will flash across the display for a second to indicate that your change has been accepted.
6. Press the **MODE** button to return to normal operation; the CAL symbol will disappear from the display.

6.2 CHANGING THE REFERENCE TEMPERATURE

Follow these steps to modify the reference temperature of the Model 85.

1. Turn the instrument on and wait for it to complete its self-test procedure.
2. Use the **MODE** button to advance the instrument to display conductivity.
3. Press and release both the **DOWN ARROW** and the **MODE** buttons at the same time.

The **CAL** symbol will appear at the bottom left of the display. The large portion of the display will show **1.91 %** (or a value set previously using Advanced Setup).

4. Press and release the **MODE** button; the large portion of the display will show **25.0C** (or a value set previously using Advanced Setup).
5. Use the **UP ARROW** or **DOWN ARROW** button to change the value to the desired new reference temperature (any value between 15 °C and 25 °C is acceptable).
6. Press the **ENTER** button. The word "**SAVE**" will flash across the display for a second to indicate that your change has been accepted.
7. The instrument will automatically return to normal operation mode.

6.3 CHANGING FROM AUTORANGING TO MANUAL RANGING

If your application is easier to perform using a manual range that you select, the YSI Model 85 allows you to turn off the default autoranging feature. While you are making conductivity or temperature compensated conductivity measurements, simply press and release the **UP ARROW** button. Each additional press of the **UP ARROW** button will cycle the Model 85 to a different manual range until you return again to autoranging. Five pushes of the **UP ARROW** button will cycle the Model 85 through the four manual ranges and return the instrument to autoranging.

NOTE: You may see an error message in some manual ranges if the manual range selected is not adequate for the sample you are measuring. If this happens, simply press and release the **UP ARROW** button again until a range is selected which is suitable for your sample. If you get lost and don't know if you're in a manual range or autoranging, simply turn the instrument off and back on. Also note that the conductivity units will flash while you are in manual range. The instrument will always default to autoranging when first turned on.

The four ranges of the YSI Model 85 are:

Range 1	Range 2	Range 3	Range 4
0 to 499.9 µS/cm	0 to 4999 µS/cm	0 to 49.99 mS/cm	0 to 200.0 mS/cm

SECTION 7 MAKING MEASUREMENTS

7.1 TURNING THE INSTRUMENT ON

Once the batteries are installed correctly, press the **ON/OFF** button. The instrument will activate all segments of the display for a few seconds, which will be followed by a self-test procedure that will last for several more seconds. During this power on self-test sequence, the instrument's microprocessor is verifying that the instrument is working properly. The Model 85 will display the cell constant of the conductivity probe when the self-test is complete. If the instrument were to detect an internal problem, the display would show a **continuous** error message. See the section entitled Troubleshooting for a list of these error messages.

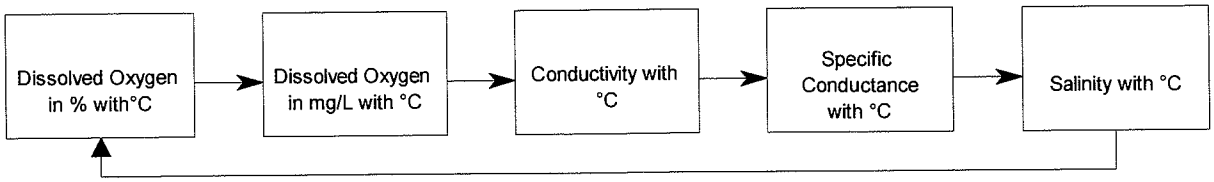
7.2 THE MEASUREMENT MODES OF THE MODEL 85

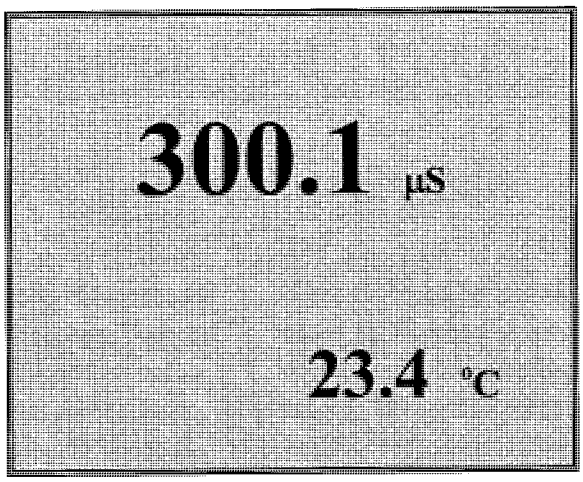
The Model 85 is designed to provide six distinct measurements:

- **Dissolved Oxygen %** -- A measurement of oxygen in percent of saturation.
- **Dissolved Oxygen mg/L** -- A measurement of oxygen in mg/L
- **Conductivity** -- A measurement of the conductive material in the liquid sample without regard to temperature
- **Specific Conductance** -- Also known as temperature compensated conductivity which automatically adjusts the reading to a calculated value which would have been read if the sample had been at 25° C (or some other reference temperature which you choose). See Advanced Setup.
- **Temperature** -- which is always displayed.
- **Salinity** -- A calculation done by the instrument electronics, based upon the conductivity and temperature readings.

NOTE: When you turn the Model 85 off, it will "remember" which mode you used last and will return to that mode the next time the instrument is turned on.

To choose one of the measurement modes above (temperature is always displayed) simply press and release the **MODE** button. Carefully observe the small legends at the far right side of the LCD.





If the instrument is reading **Specific Conductance** the large numbers on the display will be followed by either a µS or an **mS.** Additionally the small portion of the display will show the ° **C** flashing on and off.

If the instrument is reading **Conductivity** (not temperature compensated) the large numbers on the display will be followed by either a µS or an **mS.** Additionally the small portion of the display will show the ° **C** **NOT** flashing.

If the instrument is reading **Dissolved Oxygen** the large numbers on the display will be followed by either a mg/L or %. It is important to remember that the dissolved oxygen probe is stirring dependent. This is due to the consumption of oxygen at the sensor tip during measurement. When taking dissolved oxygen measurements the probe must be moved through the sample at a rate of 1 foot per second to provide adequate stirring.

If the instrument is reading **Salinity** the large numbers on the display will be followed by a **ppt.**

7.3 AUTORANGING & RANGE SEARCHING

The YSI Model 85 is an autoranging instrument. This means that regardless of the conductivity or salinity of the solution (within the specifications of the instrument) all you need to do to get the most accurate reading is to put the probe in the sample. This feature makes the Model 85 as simple as possible to operate.

When you first place the Model 85 probe into a sample or calibration solution, and again when you first remove the probe the instrument will go into a range search mode that may take as long as 5 seconds. During some range searches the instrument display will flash **rANG** to indicate its movement from one range to another. The length of the range search depends on the number of ranges that must be searched in order to find the correct range for the sample. During the range search, the instrument will appear to freeze on a given reading for a few seconds then, once the range is located, will pinpoint the exact reading on the display. The display may also switch to **00.0** for a second or two during a range search before it selects the proper range.

7.4 THE BACKLIGHT

At times it may be necessary to take measurements with the Model 85 in dark or poorly lit areas. To help in this situation, the Model 85 comes equipped with a backlight that will illuminate the display so that it can be easily read. To activate the backlight, press and hold the **LIGHT** button. The

display will remain lit as long as the button is depressed. When you release it, the light goes out to preserve battery life.

SECTION 8 SAVING DATA

The Model 85 is equipped with non-volatile memory that is capable of storing up to 50 different sets of readings. Non-volatile means that you do not need to worry that your data will be lost due to a power failure or power interrupt. The Model 85 will also assign a site identity number to each set of readings to allow easy review of the data. This feature is useful in situations where transcribing data is difficult or not available.

8.1 SAVING DATA TO MEMORY

1. While any parameter is displayed on the screen depress the **ENTER** button and hold for approximately 2 seconds. The meter will flash **SAVE** on the display along with the current site identity being used.

2. When all 50 sites are full the display will flash **FULL** on the screen. This message will remain on the screen (even after power down) until a button is pushed.

Once you have acknowledged the memory is full, any subsequent saved data will begin overwriting existing data starting with site #1.

8.2 RECALLING STORED DATA

1. To put the Model 85 into the **RECALL** mode depress the **MODE** button repeatedly until **rcl** is displayed on the screen along with the site ID number in the lower right corner. (see figure #1)

2. Depress the **ENTER** button to review the last set of data that was saved. The Model 85 will display the dissolved oxygen in % saturation and temperature. Another press of the **ENTER** button will display the dissolved oxygen in mg/L and the temperature.

Depress the **ENTER** button again and again to review the conductivity, specific conductivity and salinity readings. All of which are displayed with the temperature.

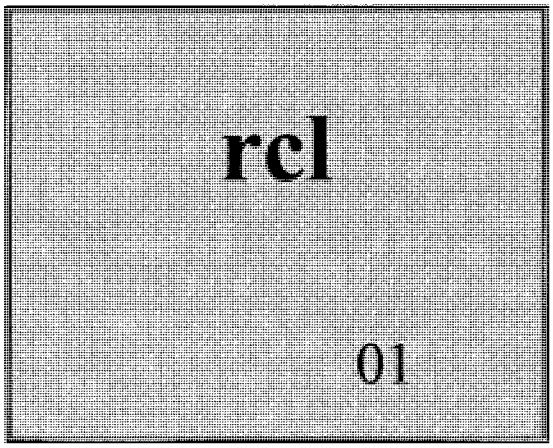


figure #1

3. Depress the **UP ARROW** button to increment through the saved sets of data.

4. Depress the **DOWN ARROW** button to decrement through the saved sets of data.

5. When the correct site ID# is displayed, press the **ENTER** button to display the data.

6. When you have finished recalling data, press the **MODE** button to return to normal operation.

NOTE: The Model 85 will recall data as a list. When the **UP ARROW** is depressed the Model 85 will display the Site ID# for the previously recorded date. For example: If you are reviewing Site ID# 5 and the **UP ARROW** is depressed the Model 85 will display Site ID# 4. If you are reviewing Site ID# 5 and Site ID# 5 was the last set of data stored the **DOWN ARROW** button will display Site ID# 1.

Here is an example of the Model 85 memory.
Site ID #1
Site ID #2
Site ID #3 ←—If the **UP ARROW** button was pressed the Model 85 would display Site ID #2
Site ID #4
Site ID #5

8.3 *ERASING STORED DATA*

1. To erase the data that is stored into the Model 85's memory, depress the **MODE** button repeatedly until the Model 85 displays **ErAS** on the screen. (see figure #2)

2. Depress and hold the **DOWN ARROW** and **ENTER** buttons simultaneously for approximately 5 seconds.

3. The Model 85 flashing DONE on the display for 1 to 2 seconds indicates successful erasure. The instrument will automatically change to normal operation after completion.

IMPORTANT: Data in all 50 site ID's will be erased completely and will be lost forever. Do not use the erase function until all recorded data has been transcribed to an archive outside the Model 85.

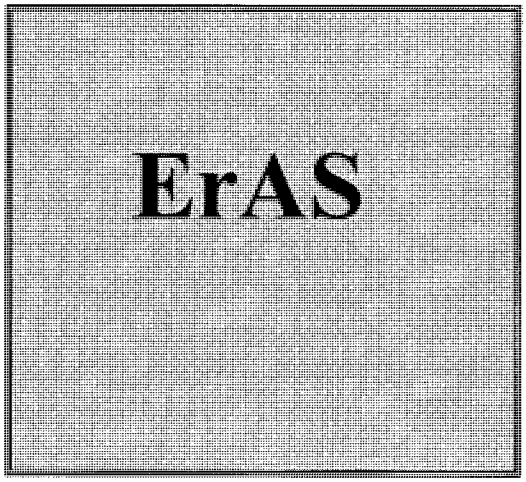


figure #2

SECTION 9 MAINTENANCE

9.1 CLEANING AND STORAGE

The single most important requirement for accurate and reproducible results in conductivity measurement is a clean cell. A dirty cell will change the conductivity of a solution by contaminating it.

NOTE: ALWAYS RINSE THE CONDUCTIVITY CELL WITH CLEAN WATER AFTER EACH USE.

To clean the conductivity cell:

1. Dip the cell in cleaning solution and agitate for two to three minutes. Any one of the foaming acid tile cleaners, such as Dow Chemical Bathroom Cleaner, will clean the cell adequately. When a stronger cleaning preparation is required, use a solution of 1:1 isopropyl alcohol and 1 N HCl. Remove the cell from the cleaning solution.

2. Use the nylon brush (supplied) to dislodge any contaminants from inside the electrode chamber.

3. Repeat steps one and two until the cell is completely clean. Rinse the cell thoroughly in deionized, or clean tap water.

4. Store the conductivity cell in the meter storage chamber.

NOTE: See Section 11, Dissolved Oxygen Probe Precautions for instructions on cleaning the dissolved oxygen electrodes.

SECTION 10 PRINCIPLES OF OPERATION

The dissolved oxygen sensor utilizes an oxygen permeable membrane that covers an electrolytic cell consisting of a gold cathode and a porous silver anode. This membrane acts as a diffusion barrier and an isolation barrier preventing fouling of the cathode surface by impurities in the environment. Upon entering the cell through the membrane, oxygen is reduced at an applied potential of -0.8 V referenced to the silver electrode. The reduction current at the cathode is directly proportional to the partial pressure of oxygen in liquid (expressed as %-air saturation) which is proportional to the concentration of dissolved oxygen (in mg/L) at a particular temperature. Thus the same partial pressure of oxygen (% air-saturation) in liquid gives different concentrations of dissolved oxygen (mg/L) at different temperatures because of the different solubility's of oxygen at different temperatures.

The conductivity cell utilizes four pure nickel electrodes for the measurement of solution conductance. Two of the electrodes are current driven, and two are used to measure the voltage drop. The measured voltage drop is then converted into a conductance value in milli-Siemens (millimhos). To convert this value to a conductivity (specific conductance) value in milli-Siemens per cm (mS/cm), the conductance is multiplied by the cell constant that has units of reciprocal cm (cm^{-1}). The cell constant for the Model 85 conductivity cell is 5.0/cm $\pm$ 4%. For most applications, the cell constant is automatically determined (or confirmed) with each deployment of the system when the calibration procedure is followed. Solutions with conductivity's of 1.00, 10.0, 50.0, and 100.0 mS/cm, which have been prepared in accordance with recommendation 56-1981 of the Organisation Internationale de Métrologie Légale (OIML) are available from YSI. The instrument output is in µS/cm or mS/cm for both conductivity and specific conductance. The multiplication of cell constant times conductance is carried out automatically by the software.

10.1 TEMPERATURE EFFECT ON CONDUCTIVITY

The conductivity of solutions of ionic species is highly dependent on temperature, varying as much as 3% for each change of one degree Celsius (temperature coefficient = 3%/C). In addition, the temperature coefficient itself varies with the nature of the ionic species present.

Because the exact composition of a natural media is usually not known, it is best to report a conductivity at a particular temperature, e.g. 20.2 mS/cm at 14 C. However, in many cases, it is also useful to compensate for the temperature dependence in order to determine at a glance if gross changes are occurring in the ionic content of the medium over time. For this reason, the Model 85 software also allows the user to output conductivity data in either raw or temperature compensated form. If "Conductivity" is selected, values of conductivity that are NOT compensated for temperature are output to the display. If "Specific Conductance" is selected, the Model 85 uses the temperature and raw conductivity values associated with each determination to generate a specific conductance value compensated to a user selected reference temperature (see Advanced Setup) between 15 C and 25 C. Additionally the user can select any temperature coefficient from 0% to 4%

(see Advanced Setup). Using the Model 85 default reference temperature and temperature coefficient (25 C and 1.91%), the calculation is carried out as in equation (1) below:

$$\text{Specific Conductance (25°C)} = \frac{\text{Conductivity}}{1 + TC * (T - 25)}$$

As noted above, unless the solution being measured consists of pure KCl in water, this temperature compensated value will be somewhat inaccurate, but the equation with a value of TC = 0.0191 will provide a close approximation for solutions of many common salts such as NaCl and NH_4Cl and for seawater.

Salinity is determined automatically from the Model 85 conductivity readings according to algorithms found in Standard Methods for the Examination of Water and Wastewater (ed. 1989). The use of the Practical Salinity Scale 1978 results in values which are unitless, since the measurements are carried out in reference to the conductivity of standard seawater at 15 C. However, the unitless salinity values are very close to those determined by the previously-used method where the mass of dissolved salts in a given mass of water (parts per thousand) was reported. Hence, the designation "ppt" is reported by the instrument to provide a more conventional output.
For further information on conductivity and the above standard information, refer to the ASTM document, Standard Methods of Test for Electrical Conductivity of Water and Industrial Wastewater, ASTM Designation D1125-82, and OIML Recommendation Number 56. ASTM symbols for conductivity, cell constant, and path length differ from those preferred in the general literature and also from those used in this manual.

SECTION 11 DISCUSSION OF MEASUREMENT ERRORS

11.1 DISSOLVED OXYGEN MEASUREMENT ERRORS

There are three basic types of error. Type 1 errors are related to limitations of instrument design and tolerances of instrument components. These are chiefly the meter linearity and the resistor tolerances. Type 2 errors are due to basic probe accuracy tolerances, chiefly background signal, probe linearity, and variations in membrane temperature coefficient. Type 3 errors are related to the operator's ability to determine the conditions at the time of calibration. If calibration is performed against more accurately known conditions, type 3 errors are appropriately reduced.

The sample calculations that follow are for a near extreme set of conditions.

TYPE 1 ERRORS

A. Meter linearity error: ±1% of full scale reading, or ±0.15 mg/l

B. Component and circuitry error: ±0.05 mg/l

TYPE 2 ERRORS

A. Temperature compensation for membrane temperature coefficient: ±0.03 mg/l

B. Temperature measurement errors: A maximum ±0.2°C probe error is equal to ±0.14 mg/l

TYPE 3 ERRORS

A. Altitude:

A 1000-foot change in altitude is equal to an error of approximately 3% at the 10 mg/l level.

B. Humidity:

Errors occur if calibration is performed at less than 100% humidity. The error varies with the temperature as follows:

TEMPERATURE	ERROR
0°C	0.02 mg/l
10°C	0.05 mg/l
20°C	0.12 mg/l
30°C	0.27 mg/l
40°C	0.68 mg/l

APPROXIMATING THE ERROR

It is unlikely that the actual error in any measurement will be the maximum possible error. A better error approximation is obtained using a root mean squared (r.m.s.) calculation:

$$\text{r.m.s. error} = \pm[1a^2 + 1b^2 + 2a^2 + 2b^2 + 3a^2 + 3b^2]^{1/2} \text{ mg/l}$$

11.2 CONDUCTIVITY MEASUREMENT ERRORS

System accuracy for conductivity measurements is equal to the sum of the errors contributed by the environment and the various components of the measurement setup. These include:

- Instrument accuracy
- Cell-constant error
- Solution temperature offset
- Cell contamination (including air bubbles)
- Electrical noise
- Galvanic effects

Only the first three are of major concern for typical measurements, although the user should also be careful to see that cells are clean and maintained in good condition at all times.

Instrument Accuracy = ± .5% maximum
The accuracy specified for the range being used is the worst case instrument error.

Cell-Constant Error = ± .5% maximum
Although YSI cells are warranted to be accurate to within one percent, you should still determine the exact cell constant of your particular cell. Contamination or physical damage to the cell can alter the cell constant. Performing a calibration will eliminate any error that might arise because of cell constant change.

YSI cells are calibrated to within one percent of the stated cell constant at a single point. We consider these products to be usefully linear over most instrument ranges. The cell constant can be calibrated to ±0.35% accuracy with YSI conductivity calibrator solutions.

Temperature Error = ± 1% maximum
The solution temperature error is the product of the temperature coefficient and the temperature offset from 25□C, expressed as a percentage of the reading that would have been obtained at 25□C. The error is not necessarily a linear function of temperature. The statement of error is derived from a 25□C temperature offset and a 3%/□C temperature coefficient.

Total Error
Considering only the above three factors, system accuracy under worst case conditions will be ±2%, although the actual error will be considerably less if recommended and properly calibrated cells and instrument ranges are used. Additional errors, which can essentially be eliminated with proper handling, are described below.

Cell Contamination
This error is usually due to contamination of the solution being measured, which occurs when solution is carried-over from the last solution measured. Thus, the instrument might be correctly

reporting the conductivity seen, but the reading does not accurately represent the value of the bulk solution. Errors will be most serious when low conductivity solutions are contaminated by carry-over from high conductivity solutions, and can then be of an order of magnitude or more.

Follow the cleaning instructions carefully before attempting low conductivity measurements with a cell of unknown history or one that has been previously used in higher value solutions.

An entirely different form of contamination sometimes occurs due to a buildup of foreign material directly on cell electrodes. While rare, such deposits have, on occasion, markedly reduced the effectiveness of the electrodes. The result is an erroneously low conductance reading.

Electrical-Noise Errors

Electrical noise can be a problem in any measurement range, but will contribute the most error and be the most difficult to eliminate when operating in the lowest ranges. The noise may be either line-conducted or radiated or both, and may require, grounding, shielding, or both.

Galvanic and Miscellaneous Effects

In addition to the error sources described above, there is another class of contributors that can be ignored for all but the most meticulous of laboratory measurements. These errors are always small and are generally completely masked by the error budget for cell-constant calibration, instrument accuracy, etc. Examples range from parasitic reactance associated with the solution container and its proximity to external objects to the minor galvanic effects resulting from oxide formation or deposition on electrodes. Only trial and error in the actual measurement environment can be suggested as an approach to reduce such errors. If the reading does not change as the setup is adjusted, errors due to such factors can be considered too small to see.

11.3 DISSOLVED OXYGEN PROBE PRECAUTIONS

1. Membrane life depends on usage. Membranes will last a long time if installed properly and treated with care. Erratic readings are a result of loose, wrinkled, damaged, or fouled membranes, or from large (more than 1/8" diameter) bubbles in the electrolyte reservoir. If erratic readings or evidence of membrane damage occurs, you should replace the membrane and the KCl solution. The average replacement interval is two to four weeks.

2. If the membrane is coated with oxygen consuming (e.g. bacteria) or oxygen evolving organisms (e.g. algae), erroneous readings may occur.

3. Chlorine, sulfur dioxide, nitric oxide, and nitrous oxide can affect readings by behaving like oxygen at the probe. If you suspect erroneous readings, it may be necessary to determine if these gases are the cause.

4. Avoid any environment that contains substances that may attack the probe materials. Some of these substances are concentrated acids, caustics, and strong solvents. The probe materials that come in contact with the sample include FEP Teflon, stainless steel, epoxy, polyetherimide and the polyurethane cable covering.

5. For correct probe operation, the gold cathode must always be bright. If it is tarnished (which can result from contact with certain gases) or plated with silver, the gold surface must be restored. To restore the cathode, you may either return the instrument to the factory or clean it using the YSI 5238 probe reconditioning kit. Never use chemicals or abrasives not supplied with this kit.

NOTE: Model 85 probes built before July, 1996 (serial numbers starting with 96F or lower), should be cleaned with the sanding disc mounted on a FLAT surface. Do NOT use the curved tool provided in the 5238 probe reconditioning kit on these probes.

6. It is also possible for the silver anode to become contaminated, which will prevent successful calibration. To clean the anode, remove the membrane and soak the probe overnight in 3% ammonium hydroxide. Next, rinse the sensor tip with deionized water, add new KCl solution, and install a new membrane. Turn the instrument on and allow the system to stabilize for at least 30 minutes. If, after several hours, you are still unable to calibrate, return the YSI Model 85 system to an authorized service center for service.

7. To keep the electrolyte from drying out, store the probe in the calibration chamber with the small piece of sponge.

SECTION 12 TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	ACTION
1. Instrument will not turn on	A. Low battery voltage B. Batteries installed wrong C. Meter requires service	A. Replace batteries B. Check battery polarity. C. Return system for service
2. Instrument will not calibrate (Dissolved Oxygen)	A. Membrane is fouled or damaged B. Probe anode is fouled or dark C. Probe cathode is tarnished D. System requires service	A. Replace membrane & KCl B. Clean anode C. Clean cathode D. Return system for service
3. Instrument will not calibrate (Conductivity)	A. Cell is contaminated	A. See "Maintenance" Section
4. Instrument "locks up"	A. Instrument has rec'd a shock B. Batteries are low or damaged C. System requires service	A & B. Remove battery lid, wait 15 seconds for reset, replace lid. C. Return system for service
5. Instrument readings are inaccurate (Dissolved Oxygen)	A. Cal altitude is incorrect B. Probe not in 100% O_2 saturated air during Cal procedure C. Membrane fouled or damaged D. Probe anode is fouled or dark E. Probe cathode is tarnished F. System requires service	A. Recalibrate w/correct value B. Moisten sponge & place in Cal chamber w/ probe & Recal C. Replace membrane D. Clean anode E. Clean cathode F. Return system for service
6. Instrument readings are inaccurate (Conductivity)	A. Calibration is required B. Cell is contaminated C. Tempco is set incorrectly D. Reference temperature incorrect E. Readings are or are not temperature compensated.	A. See "Calibration" Section B. See "Maintenance" Section C. See "Advanced Setup" Section D. See "Advanced Setup" Section E. See "Making Measurements" Section
7..LCD displays "LO BAT" Main display flashes "off"	A. Batteries are low or damaged	A. Replace batteries
8. Main Display reads "OVEr" (Secondary display reads "ovr") (Secondary display reads "udr")	A. Conductivity reading is >200 mS B. Temperature reading is >65°C C. Temperature reading is <-5°C D. Salinity reading is >80 ppt E. User cell constant cal K is >5.25 F. DO temperature is >46°C G. DO % saturation is >200% H. DO concentration is >20 mg/L	In all cases, check calibration values and procedures; check advanced setup settings. If each of these are set correctly, return instrument for service.
9. Main display reads "Undr"	A. User cell constant cal K is <4.9 B. DO current too low to calibrate	A. Recalibrate instrument using known good conductivity standard. Follow cell cleaning procedure in the Maintenance section. B. Replace membrane, clean probe
10. Main display reads "rErr"	A. Reading exceeds user selected manual range.	A. Use the mode key to select a higher or lower manual range, or set system to autoranging.
11. Main display reads "PErr"	A. User cell constant cal K is 0.0 B. Incorrect sequence of keystrokes.	A. See "Advanced Setup" section. B. Refer to manual section for step by step instruction for the function you are attempting.

SYMPTOM	POSSIBLE CAUSE	ACTION
12. Main display reads "LErr"	A. In temperature compensated conductivity mode, temperature exceeds the values computed using user defined temperature coefficient and/or reference temperature. B. In cell constant cal mode, temperature exceeds the values computed using user defined temperature coefficient and/or reference temperature.	A. & B. Adjust user defined tempco or reference temperature. (pg. 10)
13. Main display reads "Err" (Secondary display reads "ra")	A. System has failed its RAM test check procedure.	A. Turn instrument OFF and back ON again. B. Return the system for service (pg. 26)
14. Main display reads "Err" (Secondary display reads "ro")	A. System has failed its ROM test check procedure.	A. Turn instrument OFF and back ON again. B. Return the system for service (pg. 26)
15. Secondary display reads "rEr"	A. Temperature jumper is set to °F and reading is >199.9°F but <203°F.	A. Return the system for service. (pg. 26)
16. Main display reads "FAIL" (Secondary display reads "eep")	A. EEPROM has failed to respond in time.	A. Return the system for service. (pg. 26)
17. Readings on main display don't change	A. Meter is in recall mode.	A. Press **MODE** button to return to Normal Operation (pg. 12)

SECTION 13 WARRANTY AND REPAIR

YSI Model 85 Handheld Meters are warranted for two years from date of purchase by the end user against defects in materials and workmanship. YSI Model 85 probes and cables are warranted for one year from date of purchase by the end user against defects in material and workmanship. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, write or call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

Limitation of Warranty

This Warranty does not apply to any YSI product damage or failure caused by (i) failure to install, operate or use the product in accordance with YSI's written instructions, (ii) abuse or misuse of the product, (iii) failure to maintain the product in accordance with YSI's written instructions or standard industry procedure, (iv) any improper repairs to the product, (v) use by you of defective or improper components or parts in servicing or repairing the product, or (vi) modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI's LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

AUTHORIZED U.S. SERVICE CENTERS

North and East Region

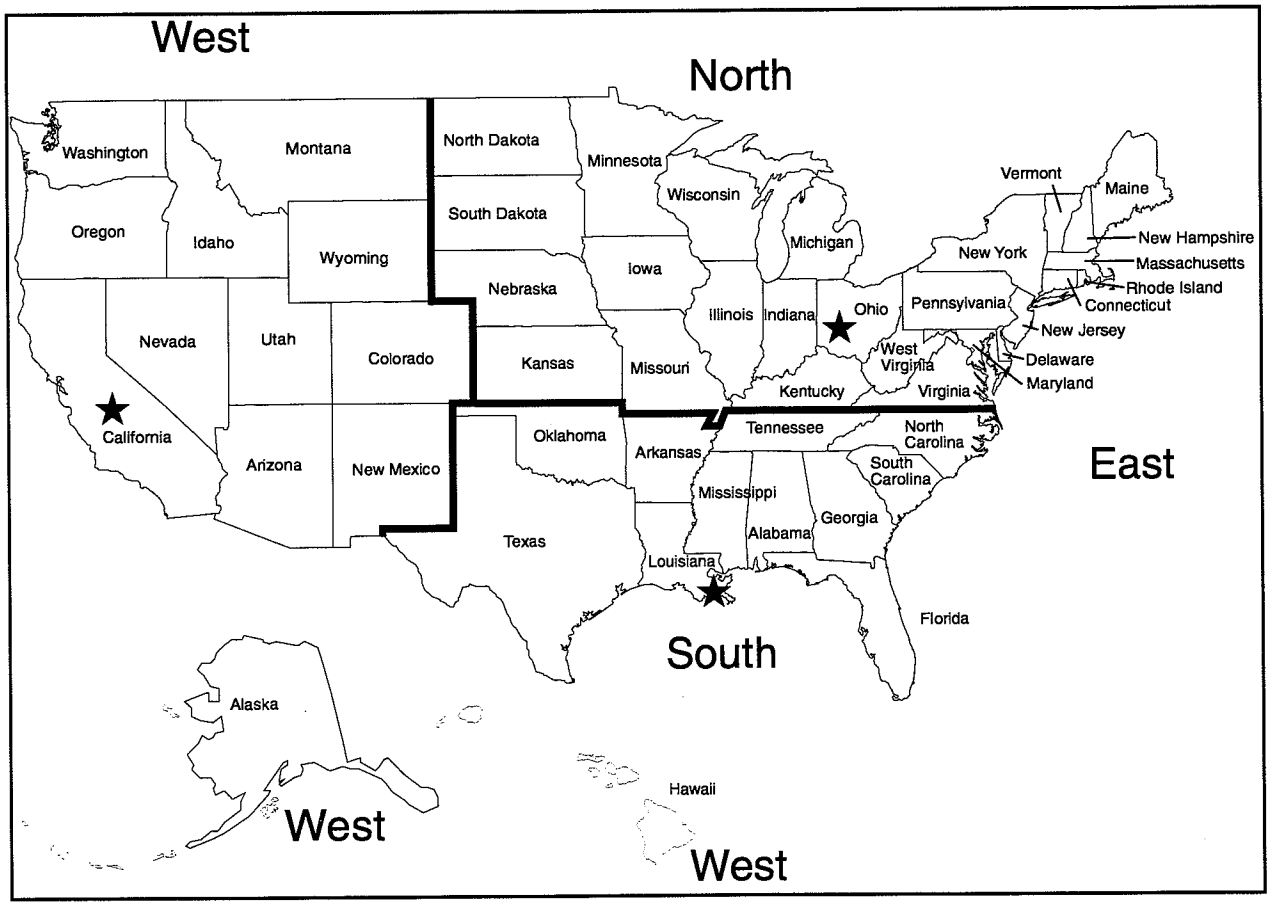
YSI Incorporated • Repair Center • 1725 Brannum Lane • Yellow Springs, Ohio • 45387 • Phone: (800) 765-4974 • (937) 767-7241• E-Mail: ysi@info.com

South Region

C.C. Lynch & Associates • 212 E. 2nd Street • Suite 203 • Pass Christian, Mississippi • 39571 • Phone: (800) 333-2252 • (228) 452-4612 • Fax: (228) 452-2563

West Region

EnviroServices & Repair • 1110 Burnett Avenue, Suite D • Concord, CA • 94520 • Phone: (800) 550-5875 • Fax: (510)674-8655



INTERNATIONAL SERVICE CENTERS

YSI Incorporated • Repair Center • 1725 Brannum Lane • Yellow Springs, Ohio • 45387 • Phone: (937) 767-7241• E-Mail: info@ysi.com

Lynchford House • Lynchford Lane • Farnborough • Hampshire • GU146LT • Phone: (44-1252) 514711 • Fax: (44-1252) 511855 • Tlx: 858210

Sakura – Building 6-5-6-13 • Shinjuku, Shinjuku-ku, Tokyo • 160 • Phone: (81-3) 5360-3561 • Fax: (81-3) 5360-3565

SPECIALTY SERVICE CENTERS

Aquaculture

Aquatic Eco Systems, Inc. • 1767 Benbow Court • Apopka, Florida • Phone: (407) 886-3939 • Fax: (407) 886-6787

Aquacenter • 166 Seven Oaks Road • Leland, Mississippi • 38756 • Phone: (601) 378-2861 • Fax: (601) 378-2862

Wastewater

Q.C. Services • P.O. Box 68 • Harrison, Maine • 04040 • Phone: (207) 583-2980

Q.C. Services • P.O. Box 14831 • Portland, Oregon • 97293 • Phone: (503) 236-2712

CLEANING INSTRUCTIONS

NOTE: Before they can be serviced, equipment exposed to biological, radioactive, or toxic materials must be cleaned and disinfected. Biological contamination is presumed for any instrument, probe, or other device that has been used with body fluids or tissues, or with wastewater. Radioactive contamination is presumed for any instrument, probe or other device that has been used near any radioactive source.

If an instrument, probe, or other part is returned or presented for service without a Cleaning Certificate, and if in our opinion it represents a potential biological or radioactive hazard, our service personnel reserve the right to withhold service until appropriate cleaning, decontamination, and certification has been completed. We will contact the sender for instructions as to the disposition of the equipment. Disposition costs will be the responsibility of the sender.

When service is required, either at the user's facility or at YSI, the following steps must be taken to insure the safety of our service personnel.

1. In a manner appropriate to each device, decontaminate all exposed surfaces, including any containers. 70% isopropyl alcohol or a solution of 1/4 cup bleach to 1-gallon tap water are suitable for most disinfecting. Instruments used with wastewater may be disinfected with .5% Lysol if this is more convenient to the user.
2. The user shall take normal precautions to prevent radioactive contamination and must use appropriate decontamination procedures should exposure occur.
3. If exposure has occurred, the customer must certify that decontamination has been accomplished and that no radioactivity is detectable by survey equipment.
4. Any product being returned to the YSI Repair Center, should be packed securely to prevent damage.
5. Cleaning must be completed and certified on any product before returning it to YSI.

PACKING INSTRUCTIONS

1. Clean and decontaminate items to insure the safety of the handler.
2. Complete and include the Cleaning Certificate.
3. Place the product in a plastic bag to keep out dirt and packing material.
4. Use a large carton, preferably the original, and surround the product completely with packing material.
5. Insure for the replacement value of the product.

Cleaning Certificate

Organization _____

Department _____

Address _____

City _____ State _ Zip _____

Country _____ Phone _____

Model No. of Device _ Lot Number _____

Contaminant (if known) _____

Cleaning Agent(s) used _____

Radioactive Decontamination Certified?

(Answer only if there has been radioactive exposure)

_____ Yes _____ No

Cleaning Certified By _____

Name Date

SECTION 14 ACCESSORIES AND REPLACEMENT PARTS

The following parts and accessories are available from YSI or any Franchise Dealer authorized by YSI.

YSI ORDER NUMBER	DESCRIPTION
YSI 5906	Replacement Membrane Cap Kit (6 each)
YSI 5238	Probe Reconditioning Kit
YSI 3161	Conductivity Calibration Solution 1,000 µ/cm (1 Quart)
YSI 3163	Conductivity Calibration Solution 10,000 µ/cm (1 Quart)
YSI 3165	Conductivity Calibration Solution 100,000 µ/cm (1 Quart)
YSI 3167	Conductivity Calibration Solution 1,000 µ/cm (8 pints)
YSI 3168	Conductivity Calibration Solution 10,000 µ/cm (8 pints)
YSI 3169	Conductivity Calibration Solution 50,000 µ/cm (8 pints)
YSI 5520	Carrying Case
YSI 118510	Replacement Probe & Cable Assembly (10 feet)
YSI 118522	Replacement Probe & Cable Assembly (25 feet)
YSI 118527	Replacement Probe & Cable Assembly (50 feet)
YSI 118519	Replacement Probe and Cable Assembly (100 feet)
YSI 038501	Replacement Front Case Cover
YSI 055242	Replacement Rear Case Cover
YSI 055244	Replacement Battery Cover Kit
YSI 055204	Replacement Case Gasket and Screw
YSI 055219	Storage Chamber Sponge
YSI 030156	Main Board Assembly
YSI 038213	Replacement Electrode Cleaning Brush

APPENDIX A SPECIFICATIONS

Operating Environment

Medium: fresh, sea, or polluted water and most other liquid solutions.
Temperature: -5 to +65 °C
Depth: 0 to 10, 0 to 25, 0 to 50, or 0 to 100 feet (depending on cable length)

Storage Temperature: -10 to +50 °C

Material: ABS, Stainless Steel, and other materials

Dimensions:

Height:	9.5 inches	(24.13 cm)
Thickness:	2.2 inches	(5.6 cm)
Width:	3.5 inches max.	(8.89 cm)
Weight:	1.7 pounds (w/ 10' cable)	(.77 kg)
Display:	2.3"W x 1.5"L	(5.8cm W x 3.8cm L)

Power: 9 VDC -6 AA-size Alkaline Batteries (included)
Approximately 100 hours operation from each new set of batteries

Water Tightness: Meets or exceeds IP65 standards

Extensive testing of the YSI Model 85 indicates the following typical performance:

Measurement	Range	Resolution	Accuracy
Conductivity	0 to 499.9 µS/cm	0.1 µS/cm	± .5% FS
	0 to 4999 µS/cm	1.0 µS/cm	± .5% FS
	0 to 49.99 mS/cm	.01 mS/cm	± .5% FS
	0 to 200.0 mS/cm	0.1 mS/cm	± .5% FS
Salinity	0 to 80 ppt	.1 ppt	± 2%, or ± 0.1 ppt
Temperature	-5 to +65 °C	0.1 °C	± 0.1 °C (±1 lsd)
Dissolved Oxygen	0 to 200 % Air Sat.	0.1% Air Saturation	± 2% Air Saturation
	0 to 20 mg/L	0.01 mg/L	± 0.3 mg/L

Adjustable Conductivity Reference Temperature: 15°C to 25°C

Adjustable Temperature Compensation Factor for Conductivity: 0% to 4%

Temperature Compensation: Automatic

Range: Autoranging for Dissolved Oxygen

User selected or Autoranging for Conductivity

Specifications

APPENDIX B - TEMPERATURE CORRECTION DATA

Temperature Correction Data for Typical Solutions

A. Potassium Chloride** (KCl)

Concentration: 1 mole/liter			Concentration: 1 x 10^{-1} mole/liter		
□C	mS/cm	%/□C (to 25□C)	□C	mS/cm	%/□C (to 25□C)
0	65.10	1.67	0	7.13	1.78
5	73.89	1.70	5	8.22	1.80
10	82.97	1.72	10	9.34	1.83
15	92.33	1.75	15	10.48	1.85
20	101.97	1.77	20	11.65	1.88
25	111.90	1.80	25	12.86	1.90
			30	14.10	1.93
			35	15.38	1.96
			37.5	16.04	1.98
			40	16.70	1.99
			45	18.05	2.02
			50	19.43	2.04

Concentration: 1 x 10^{-2} mole/liter			Concentration: 1 x 10^{-3} mole/liter		
□C	mS/cm	%/□C (to 25□C)	□C	mS/cm	%/□C (to 25□C)
0	0.773	1.81	0	0.080	1.84
5	0.892	1.84	5	0.092	1.88
10	1.015	1.87	10	0.105	1.92
15	1.143	1.90	15	0.119	1.96
20	1.275	1.93	20	0.133	1.99
25	1.412	1.96	25	0.147	2.02
30	1.553	1.99	30	0.162	2.05
35	1.697	2.02	35	0.178	2.07
37.5	1.771	2.03	37.5	0.186	2.08
40	1.845	2.05	40	0.194	2.09
45	1.997	2.07	45	0.210	2.11
50	2.151	2.09	50	0.226	2.13

** Charts developed by interpolating data from International Critical Tables, Vol. 6, pp. 229-253, McGraw-Hill Book Co., NY.

B. Sodium Chloride* (NaCl)

Saturated solutions at all temperatures		
□C	mS/cm	%/□C (to 25□C)
0	134.50	1.86
5	155.55	1.91
10	177.90	1.95
15	201.40	1.99
20	225.92	2.02
25	251.30	2.05
30	277.40	2.08

Concentration: 0.5 mole/liter		
□C	mS/cm	%/□C (to 25 □C)
0	25.90	1.78
5	29.64	1.82
10	33.61	1.86
15	37.79	1.90
20	42.14	1.93
25	46.65	1.96
30	51.28	1.99
35	56.01	2.01
37.5	58.40	2.02
40	60.81	2.02
45	65.65	2.04
50	70.50	2.05

Concentration: 1 x 10^{-1} mole/liter		
□C	mS/cm	%/□C (to 25□C)
0	5.77	1.83
5	6.65	1.88
10	7.58	1.92
15	8.57	1.96
20	9.60	1.99
25	10.66	2.02
30	11.75	2.04
35	12.86	2.06
37.5	13.42	2.07
40	13.99	2.08
45	15.14	2.10
50	16.30	2.12

Concentration: 1 x 10^{-2} mole/liter		
□C	mS/cm	%/□C (to 25□C)
0	0.632	1.87
5	0.731	1.92
10	0.836	1.97
15	0.948	2.01
20	1.064	2.05
25	1.186	2.09
30	1.312	2.12
35	1.442	2.16
37.5	1.508	2.17
40	1.575	2.19
45	1.711	2.21
50	1.850	2.24

Concentration: 1 x 10^{-3} mole/liter		
□C	mS/cm	%/□C (to 25□C)
0	0.066	1.88
5	0.076	1.93
10	0.087	1.98
15	0.099	2.02
20	0.111	2.07
25	0.124	2.11
30	0.137	2.15
35	0.151	2.19
37.5	0.158	2.20
40	0.165	2.22
45	0.180	2.25
50	0.195	2.29

* Charts developed by interpolating data from the CRC Handbook of Chemistry and Physics, 42nd ed., p. 2606, The Chemical Rubber Company, Cleveland.

C. Lithium Chloride* (LiCl)

Concentration: 1 mole/liter			Concentration: 1 x 10^{-1} mole/liter		
□C	mS/cm	%/□C (to 25□C)	□C	mS/cm	%/□C (to 25□C)
0	39.85	1.82	0	5.07	1.87
5	46.01	1.85	5	5.98	1.85
10	52.42	1.89	10	6.87	1.85
15	59.07	1.92	15	7.75	1.85
20	65.97	1.95	20	8.62	1.85
25	73.10	1.98	25	9.50	1.86
30	80.47	2.02	30	10.40	1.88
35	88.08	2.05	35	11.31	1.91
37.5	91.97	2.07	37.5	11.78	1.92
40	95.92	2.08	40	12.26	1.94
45	103.99	2.11	45	13.26	1.98
50	112.30	2.15	50	14.30	2.02

Concentration: 1 x 10^{-2} mole/liter			Concentration: 1 x 10^{-3} mole/liter		
□C	mS/cm	%/□C (to 25□C)	□C	mS/cm	%/□C (to 25□C)
0	0.567	1.88	0	0.059	1.93
5	0.659	1.92	5	0.068	2.03
10	0.755	1.96	10	0.078	2.12
15	0.856	2.00	15	0.089	2.19
20	0.961	2.04	20	0.101	2.25
25	1.070	2.08	25	0.114	2.28
30	1.183	2.12	30	0.127	2.31
35	1.301	2.16	35	0.140	2.32
37.5	1.362	2.18	37.5	0.147	2.32
40	1.423	2.20	40	0.154	2.31
45	1.549	2.24	45	0.166	2.29
50	1.680	2.28	50	0.178	2.25

D. Potassium Nitrate** (KNO_3)

Concentration: 1 x 10^{-1} mole/liter			Concentration: 1 x 10^{-2} mole/liter		
□C	mS/cm	%/□C (to 25□C)	□C	mS/cm	%/□C (to 25□C)
0	6.68	1.78	0	0.756	1.77
5	7.71	1.79	5	0.868	1.80
10	8.75	1.81	10	0.984	1.83
15	9.81	1.83	15	1.105	1.86
20	10.90	1.85	20	1.229	1.88
25	12.01	1.87	25	1.357	1.90
30	13.15	1.90	30	1.488	1.93
35	14.32	1.92	35	1.622	1.95
37.5	14.92	1.94	37.5	1.690	1.96
40	15.52	1.95	40	1.759	1.97
45	16.75	1.97	45	1.898	1.99
50	18.00	2.00	50	2.040	2.01

* Charts developed by interpolating data from the CRC Handbook of Chemistry and Physics, 42nd ed., p. 2606, The Chemical Rubber Company, Cleveland.
** Charts developed by interpolating data from International Critical Tables, Vol. 6, pp. 229-253, McGraw-Hill Book Co., NY.

E. Ammonium Chloride* (NH_4Cl)

Concentration: 1 mole/liter		
□C	mS/cm	%/□C (to 25□C)
0	64.10	1.60
5	74.36	1.53
10	83.77	1.45
15	92.35	1.37
20	100.10	1.29
25	107.00	1.21

Concentration: 1 x 10^{-1} mole/liter		
□C	mS/cm	%/□C (to 25□C)
0	6.96	1.82
5	7.98	1.88
10	9.09	1.93
15	10.27	1.97
20	11.50	2.00
25	12.78	2.03
30	14.09	2.06
35	15.43	2.07
37.5	16.10	2.08
40	16.78	2.08
45	18.12	2.09
50	19.45	2.09

Concentration: 1 x 10^{-2} mole/liter		
□C	mS/cm	%/□C (to 25□C)
0	0.764	1.84
5	0.889	1.86
10	1.015	1.88
15	1.144	1.91
20	1.277	1.94
25	1.414	1.97
30	1.557	2.02
35	1.706	2.06
37.5	1.782	2.08
40	1.860	2.10
45	2.020	2.14
50	2.186	2.18

Concentration: 1 x 10^{-3} mole/liter		
□C	mS/cm	%/□C (to 25□C)
0	0.078	1.88
5	0.092	1.90
10	0.105	1.91
15	0.119	1.93
20	0.133	1.95
25	0.148	1.98
30	0.162	2.01
35	0.178	2.04
37.5	0.186	2.06
40	0.194	2.07
45	0.210	2.11
50	0.227	2.15

* Charts developed by interpolating data from the CRC Handbook of Chemistry and Physics, 42nd ed., p. 2606, The Chemical Rubber Company, Cleveland.

APPENDIX C REQUIRED NOTICE

The Federal Communications Commission defines this product as a computing device and requires the following notice:

This equipment generates and uses radio frequency energy and if not installed and used properly, may cause interference to radio and television reception. There is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- re-orient the receiving antenna
- relocate the computer with respect to the receiver
- move the computer away from the receiver
- plug the computer into a different outlet so that the computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet, prepared by the Federal Communications Commission, helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 0004-000-00345-4.

APPENDIX D CONVERSION CHART

TO CONVERT FROM	TO	EQUATION
Feet	Meters	Multiply by 0.3048
Meters	Feet	Multiply by 3.2808399
Degrees Celsius	Degrees Fahrenheit	(9/5□°C)+32
Degrees Fahrenheit	Degrees Celsius	5/9□(°F-32)
Milligrams per liter (mg/l)	Parts per million (ppm)	Multiply by 1

APPENDIX E OXYGEN SOLUBILITY TABLE

Table A: Solubility of Oxygen in mg/l in Water Exposed to Water-Saturated Air at 760 mm Hg Pressure.
Salinity = Measure of quantity of dissolved salts in water.
Chlorinity = Measure of chloride content, by mass, of water.
$S(^0/_{00}) = 1.80655 \times \text{Chlorinity } (^0/_{00})$

Temp °C	Chlorinity:0 Salinity:0	5.0 ppt 9.0 ppt	10.0 ppt 18.1 ppt	15.0 ppt 27.1 ppt	20.0 ppt 36.1 ppt	25.0 ppt 45.2 ppt
0.0	14.62	13.73	12.89	12.10	11.36	10.66
1.0	14.22	13.36	12.55	11.78	11.07	10.39
2.0	13.83	13.00	12.22	11.48	10.79	10.14
3.0	13.46	12.66	11.91	11.20	10.53	9.90
4.0	13.11	12.34	11.61	10.92	10.27	9.66
5.0	12.77	12.02	11.32	10.66	10.03	9.44
6.0	12.45	11.73	11.05	10.40	9.80	9.23
7.0	12.14	11.44	10.78	10.16	9.58	9.02
8.0	11.84	11.17	10.53	9.93	9.36	8.83
9.0	11.56	10.91	10.29	9.71	9.16	8.64
10.0	11.29	10.66	10.06	9.49	8.96	8.45
11.0	11.03	10.42	9.84	9.29	8.77	8.28
12.0	10.78	10.18	9.62	9.09	8.59	8.11
13.0	10.54	9.96	9.42	8.90	8.41	7.95
14.0	10.31	9.75	9.22	8.72	8.24	7.79
15.0	10.08	9.54	9.03	8.54	8.08	7.64
16.0	9.87	9.34	8.84	8.37	7.92	7.50
17.0	9.67	9.15	8.67	8.21	7.77	7.36
18.0	9.47	8.97	8.50	8.05	7.62	7.22
19.0	9.28	8.79	8.33	7.90	7.48	7.09
20.0	9.09	8.62	8.17	7.75	7.35	6.96
21.0	8.92	8.46	8.02	7.61	7.21	6.84
22.0	8.74	8.30	7.87	7.47	7.09	6.72
23.0	8.58	8.14	7.73	7.34	6.96	6.61

Temp °C	Chlorinity:0 Salinity:0	5.0 ppt 9.0 ppt	10.0 ppt 18.1 ppt	15.0 ppt 27.1 ppt	20.0 ppt 36.1 ppt	25.0 ppt 45.2 ppt
24.0	8.42	7.99	7.59	7.21	6.84	6.50
25.0	8.26	7.85	7.46	7.08	6.72	6.39
26.0	8.11	7.71	7.33	6.96	6.62	6.28
27.0	7.97	7.58	7.20	6.85	6.51	6.18
28.0	7.83	7.44	7.08	6.73	6.40	6.09
29.0	7.69	7.32	6.96	6.62	6.30	5.99
30.0	7.56	7.19	6.85	6.51	6.20	5.90
31.0	7.43	7.07	6.73	6.41	6.10	5.81
32.0	7.31	6.96	6.62	6.31	6.01	5.72
33.0	7.18	6.84	6.52	6.21	5.91	5.63
34.0	7.07	6.73	6.42	6.11	5.82	5.55
35.0	6.95	6.62	6.31	6.02	5.73	5.46
36.0	6.84	3.52	6.22	5.93	5.65	5.38
37.0	6.73	6.42	6.12	5.84	5.56	5.31
38.0	6.62	6.32	6.03	5.75	5.48	5.23
39.0	6.52	6.22	5.98	5.66	5.40	5.15
40.0	6.41	6.12	5.84	5.58	5.32	5.08
41.0	6.31	6.03	5.75	5.49	5.24	5.01
42.0	6.21	5.93	5.67	5.41	5.17	4.93
43.0	6.12	5.84	5.58	5.33	5.09	4.86
44.0	6.02	5.75	5.50	5.25	5.02	4.79
45.0	5.93	5.67	5.41	5.17	4.94	4.72

* This table is provided for your information only. It is **NOT** required when calibrating the Model 85 in accordance with the instructions outlined in the section entitled Calibration.

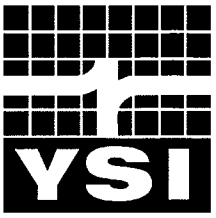
APPENDIX F CALIBRATION VALUES TABLE

Table A: Calibration values for various atmospheric pressures and altitudes.
Note: This table is for your information only. It is not required for calibration.

Pressure Inches of Hg	Pressure mm Hg	Pressure kPA	Altitude in feet	Altitude in meters	Calibration Value in %
30.23	768	102.3	-276	-84	101
29.92	760	101.3	0	0	100
29.61	752	100.3	278	85	99
29.33	745	99.3	558	170	98
29.02	737	98.3	841	256	97
28.74	730	97.3	1126	343	96
28.43	722	96.3	1413	431	95
28.11	714	95.2	1703	519	94
27.83	707	94.2	1995	608	93
27.52	699	93.2	2290	698	92
27.24	692	92.2	2587	789	91
26.93	684	91.2	2887	880	90
26.61	676	90.2	3190	972	89
26.34	669	89.2	3496	1066	88
26.02	661	88.2	3804	1160	87
25.75	654	87.1	4115	1254	86
25.43	646	86.1	4430	1350	85
25.12	638	85.1	4747	1447	84
24.84	631	84.1	5067	1544	83
24.53	623	83.1	5391	1643	82
24.25	616	82.1	5717	1743	81
23.94	608	81.1	6047	1843	80
23.62	600	80.0	6381	1945	79
23.35	593	79.0	6717	2047	78
23.03	585	78.0	7058	2151	77
22.76	578	77.0	7401	2256	76
22.44	570	76.0	7749	2362	75
22.13	562	75.0	8100	2469	74
21.85	555	74.0	8455	2577	73
21.54	547	73.0	8815	2687	72
21.26	540	71.9	9178	2797	71
20.94	532	70.9	9545	2909	70
20.63	524	69.9	9917	3023	69
20.35	517	68.9	10293	3137	68

Calibration Values Table

YSI *incorporated*



1700/1725 Brannum Lane
Yellow Springs, Ohio 45387
(800) 765-4974 (937) 767-7241
FAX (937) 767-9320
E-mail: Info@YSI.com
Website: http://www.YSI.com

ITEM # 038503
DRW # A38503
Revision E
November 1998

APPENDIX 3

YSI Professional Plus User Manual

YSI®

Professional *Plus*

USER MANUAL

Item # 605596
Rev D
Drawing # A605596
March 2009

Item # 605596
Rev D
Drawing # A605596
March 2009

CONTENTS

THIS PAGE LEFT INTENTIONALLY BLANK

WARRANTY

The YSI Professional Plus Instrument (Pro Plus) is warranted for three (3) years from date of purchase by the end user against defects in materials and workmanship, exclusive of batteries and any damage caused by defective batteries. Pro Plus field cables are warranted for two (2) years from date of purchase by the end user against defects in material and workmanship (6 months for non-field rugged cables*). Pro Plus sensors (pH, ORP, pH/ORP combo, Polarographic DO) are warranted for one (1) year from date of purchase by the end user against defects in material and workmanship (6 months for ammonium**, nitrate**, chloride**, and Galvanic DO). Pro Plus systems (instrument, cables & sensors) are warranted for 90 days from date of purchase by the end user against defects in material and workmanship when purchased by rental agencies for rental purposes. Within the warranty period, YSI will repair or replace, at its sole discretion, free of charge, any product that YSI determines to be covered by this warranty.

To exercise this warranty, call your local YSI representative, or contact YSI Customer Service in Yellow Springs, Ohio at +1 937 767-7241, 800-897-4151 or visit www.YSI.com (Support tab) for a Product Return Form. Send the product and proof of purchase, transportation prepaid, to the Authorized Service Center selected by YSI. Repair or replacement will be made and the product returned, transportation prepaid. Repaired or replaced products are warranted for the balance of the original warranty period, or at least 90 days from date of repair or replacement.

LIMITATION OF WARRANTY

This Warranty does not apply to any YSI product damage or failure caused by:

1. failure to install, operate or use the product in accordance with YSI's written instructions;
2. abuse or misuse of the product;
3. failure to maintain the product in accordance with YSI's written instructions or standard industry procedure;
4. any improper repairs to the product;
5. use by you of defective or improper components or parts in servicing or repairing the product;
6. modification of the product in any way not expressly authorized by YSI.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. YSI's LIABILITY UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT OF THE PRODUCT, AND THIS SHALL BE YOUR SOLE AND EXCLUSIVE REMEDY FOR ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY. IN NO EVENT SHALL YSI BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM ANY DEFECTIVE PRODUCT COVERED BY THIS WARRANTY.

* The warranty period for the non-field rugged cables (605107, 605177, 605108, 605178, 605109, 605179) is listed as 6 months. However, the true "working life" of these sensors may be 3-9 months depending on storage and usage in solutions other than clean aqueous samples.

** The warranty for the ammonium, nitrate, and chloride sensors (605104, 605105, 605106) is listed as 6 months. However, the true "working life" of these sensors may be 3-9 months depending on storage and usage in solutions other than clean aqueous samples.

INTRODUCTION

Thank you for purchasing the YSI Professional Plus (Pro Plus). The Pro Plus features a waterproof (IP-67) case, backlit display and keypad, user-selectable cable options, USB connectivity, large memory with extensive site list capabilities, and a rugged, rubber over-molded case.

Reading the entire manual before use is recommended for an overall understanding of the instrument's features.

GETTING STARTED

INITIAL INSPECTION

Carefully unpack the instrument and accessories and inspect for damage. Compare received parts with items on the packing list. If any parts or materials are damaged, contact YSI Customer Service at 800-897-4151 (+1 937 767-7241) or the authorized YSI distributor from whom the instrument was purchased.

BATTERY INSTALLATION

The Pro Plus requires (2) alkaline C-cell batteries which are included with the purchase of a new instrument. Battery life depends on parameters and usage. Under normal conditions, battery life is approximately 80 hours for continuous use at room temperature. To install or replace the batteries:

1. Turn the instrument over to view the battery cover on the back.
2. Unscrew the four captive battery cover screws.
3. Remove the battery cover and install the new batteries, ensuring correct polarity alignment on the instrument or the removed cover. (Figure 1)
4. Replace the battery cover on the back of the instrument and tighten the four screws. Do NOT over-tighten.

Figure 1. Pro Plus with battery cover removed. Notice battery symbols indicating polarities.

Batteries must be installed in the instrument even if powering the unit via the USB connection. This will retain the correct date and time if the PC is turned off. If the USB power is disconnected and there are no batteries in the instrument, the date and time will need to be reset upon subsequent power on.

NOTE - On subsequent battery changes you will have approximately 2 minutes to change the batteries before the clock resets. If the clock resets, the instrument will automatically bring up the Date/Time menu the next time it is powered on in order to update this information. This is important, especially if you intend to log data!

SETUP

The Pro Plus instrument has several compatible field-rugged cable/sensor options, each with temperature:

Cable:	*Available Sensors:*
Cable number 60520-x	DO/temp (605780 for lab BOD)
Cable number 60530-x	Conductivity/temp
Cable number 60510-x	ISE*/temp
Cable number 6051010-x	ISE*/ISE*/temp
Cable number 6051020-x	ISE*/DO/temp
Cable number 6051030-x	ISE*/conductivity/temp
Cable number 6052030-x	DO/conductivity/temp
Cable number 605790-x	DO/conductivity/ISE*/ISE*/temp (Quatro**)

*ISE (Ion Selective Electrode) notates a port that can accept pH, ORP, Ammonium, Nitrate, Chloride, and, in some cases, a pH/ORP combination sensor.

**Cable 605790 will be referred to as a Quatro cable throughout this manual.

All cables come in standard lengths of 1, 4, 10, 20, and 30-meters (3.28, 13, 32.8, 65.6, and 98.4-feet) with options for special order lengths up to 100-meters (328-feet) on the 60520-x cables. Contact YSI or your local representative for additional information.

In addition there are several cable options with built in sensors for the measurement of pH and ORP that are not considered field-rugged (non-replaceable sensors, less rugged single-junction sensors). These cables are

recommended for lab use or controlled conditions where a more rugged, field cable is not necessary. These cables include:

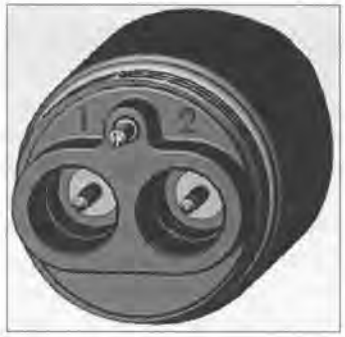
Cable number 605107	1-meter cable; single-junction pH sensor
Cable number 605177	4-meter cable; single-junction pH sensor
Cable number 605108	1-meter cable; single-junction ORP sensor
Cable number 605178	4-meter cable; single-junction ORP sensor
Cable number 605109	1-meter cable; single-junction pH/ORP sensors
Cable number 605179	4-meter cable; single-junction pH/ORP sensors

STANDARD PRO SERIES SENSOR INSTALLATION

Throughout the manual, the term "sensor" refers to the removable portion or electrode sensing portion of the cable assembly. For example, the DO sensor or pH sensor is the part that can be removed from a field cable and replaced with a new sensor. The conductivity sensor is not removable from a non-Quatro cable but still refers to the "sensing" portion and will be referred to as a sensor. This section covers most of the sensor installations on a Professional Series cable bulkhead including the following sensors:

2003 - Polarographic DO (black)	1001 - pH	1003 - pH/ORP	1005 - Chloride
2002 - Galvanic DO (gray)	1002 - ORP	1004 - Ammonium	1006 - Nitrate

See the next section of this manual for installation instructions for the Quatro cable's Conductivity/Temperature sensor.



Dual sensor bulkhead ports are numbered 1 and 2, see figure to the left. Please refer to the following tables to determine correct sensor installation into each port of a two port cable.

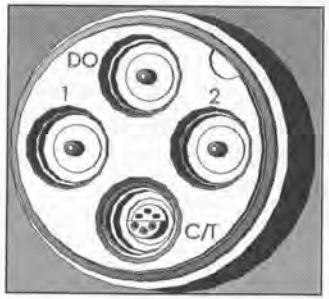
	Port 1 Options	*Port 2 Options*
1010 dual cable	pH	pH
	ORP	ORP
	pH or pH/ORP*	pH or pH/ORP*
	ammonium	ammonium
	chloride	chloride
	nitrate	nitrate
		none (port plug)

* If using a 6051010 cable, a sensor must be installed in port 1 for correct operation. If you install a pH/ORP combo sensor into a 6051010 cable, ORP will not be measured. It is not recommended to use a pH/ORP combo sensor on a 6051010 cable.

	Port 1 Options	*Port 2 Options*
1020 dual cable	pH	Polarographic DO
	ORP	Galvanic DO
	pH or pH/ORP	none (port plug)
	ammonium	
	chloride	
	nitrate	
	none (port plug)	

If using a 1020 cable, install a pH, ORP, pH/ORP, Ammonium, Nitrate or Chloride sensor in port 1 and a DO sensor in port 2.

If using a 605103 pH/ORP combination probe on a 6051020 or 6051030 cable you can report both pH and ORP. However, it is recommended to set ISE1 as pH and ISE2 as ORP in the Sensor Setup menu.



The Quatro cable bulkheads are labeled 1, 2, DO, and CT, see figure to the left. All sensors except the Conductivity/Temperature sensor can be installed following the Standard Pro Series Sensor Installation instructions. Conductivity/Temperature sensor installation is described in the next section. For ease of installation, YSI recommends that you install a sensor into port 1 first; followed by DO installation, then port 2, and lastly C/T.

	Port 1 Options	*Port 2 Options*	*DO Port Options*	*CT Port Options*
Quatro Cable (pn: 605790)	pH	pH	Polarographic DO	5560 Conductivity/ Temperature sensor only
	ORP	ORP	Galvanic DO	
	pH or pH/ ORP*	pH or pH/ ORP*	none (port plug)	
	ammonium	ammonium		
	chloride	chloride		
	nitrate	nitrate		
		none (port plug)		

* If using a Quatro cable, a sensor must be installed in port 1 for correct operation of port 2. If you install a pH/ORP combo sensor into a Quatro cable, ORP will not be measured. It is not recommended to use a pH/ORP combo sensor on a Quatro cable.

Before installing either dissolved oxygen sensor, the instrument must be configured for the sensor being installed. See the Setup - Dissolved Oxygen section of this manual for instrument configuration instructions. Failure to do this may result in damage not covered under warranty.

First, ensure both the sensor connector and sensor port on the cable are clean and dry. To connect the sensor, grasp the sensor with one hand and the sensor connection end of the cable (bulkhead) in the other. Push the sensor into the connector on the cable until it is properly seated and only one o-ring is visible. Failure to properly seat the probe may result in damage. Twist the sensor clockwise to engage threads and finger tighten (Figure 2). Do not use a tool. This connection is waterproof. Please refer to the sensor installation sheet that is included with each sensor for detailed instructions.

Figure 2. The image on the left shows a clean, dry sensor being aligned with the bulkhead. On the right, the sensor has been pushed into the bulkhead and is being screwed into place.

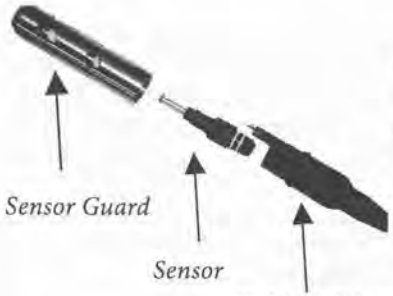


Figure 3. The sensor(s) will install directly in the cable bulkhead. Once installed, the sensor guard will protect the sensor during sampling (DO cap membrane not shown).

CONDUCTIVITY/TEMPERATURE SENSOR INSTALLATION IN A QUATRO CABLE

As mentioned, the installation of the Conductivity/Temperature sensor (model 5560) in a Quatro cable is different from all other Pro Series sensor installations. Follow these instructions when installing a conductivity/temperature sensor in a Quatro cable:

1. Locate the C/T port and, if replacing, remove the old sensor using the installation tool to loosen the stainless steel retaining nut. Once the stainless steel retaining nut has been completely unscrewed from the bulkhead, remove the old sensor from the bulkhead by pulling the sensor straight out of the bulkhead.
2. Apply a thin coat of o-ring lubricant (supplied with the sensor) to the o-rings on the connector side of the new sensor.

> ⓘ *Visually inspect the port for moisture. If moisture is found, it must be completely dried prior to sensor installation.*

3. Align the connectors of the new sensor and the port. With connectors aligned, push the sensor in towards the bulkhead until you feel the sensor seat in its port. You will experience some resistance as you push the sensor inward, this is normal
4. Once you feel the sensor seat into the port, gently rotate the stainless steel sensor nut clockwise with your fingers, Do not use the tool.
5. The nut must be screwed in by hand. If the nut is difficult to turn, STOP, as this may indicate cross threading. If you feel resistance or cross threading at any point, unscrew the nut and try again until you are able to screw the nut down completely without feeling any resistance. Damage to your cable/sensor may occur if you force the parts together.
6. Once completely installed, the nut will seat flat against the bulkhead. At this point, use the tool that was included with the sensor to turn the nut an additional ¼ to ½ turn so it cannot come loose (figure 4). DO NOT over tighten.

> ⓘ *Do not cross thread the sensor nut. Seat nut on face of bulkhead. Do not over tighten.*

Please refer to the sensor installation sheet that is included with the conductivity/temperature sensor for detailed instructions.

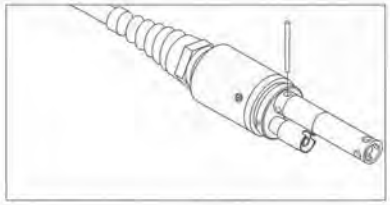


Figure 4. Installation tool used to tighten stainless steel retaining nut of 5560 conductivity/temperature sensor.

INSTALLING PORT PLUGS IN UNUSED PORTS

As necessary, install a port plug into any port that does not have an installed sensor. This will protect the bulkhead from water damage. Port plugs and a tube of o-ring lubricant are included with all Quatro cables. These items can be ordered separately if needed. To install a port plug, apply a thin coat of o-ring lubricant to the two o-rings on the port plug. After application, there should be a thin coat of o-ring lubricant on the o-rings. Remove any excess o-ring lubricant from the o-ring and/or port plug with a lens cleaning tissue. Next, insert the plug into an empty port on the bulkhead and press firmly until seated. Then, turn the plug clockwise to engage the threads and finger-tighten until the plug is installed completely. Do ***not*** use a tool to tighten the plug.

CONNECTING THE CABLE TO AN INSTRUMENT

To connect a cable, align the keys on the cable connector to the slots on the instrument connector. Push together firmly, then twist the outer ring until it locks into place (figure 5). This connection is water-proof.

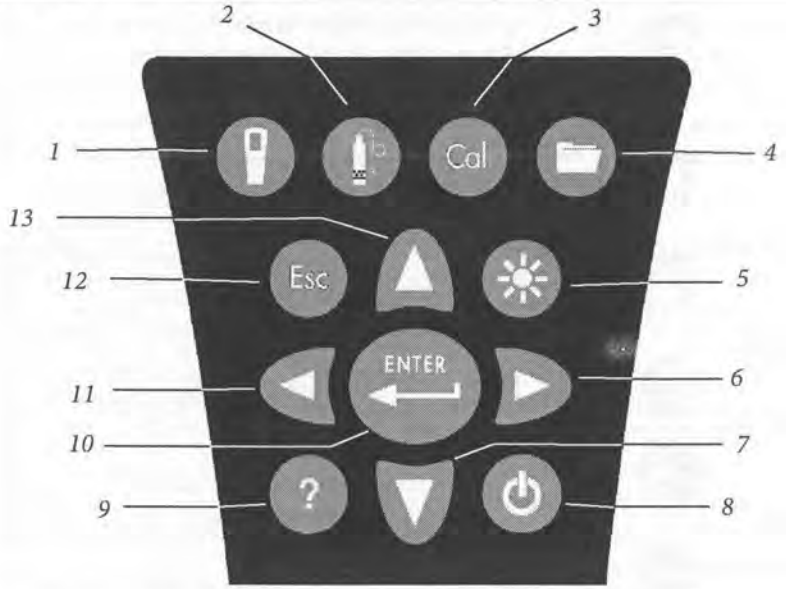
Figure 5. Note the keyed connector. The cable and instrument connectors can only be mated once the keys are properly aligned.

> *When a sensor is not installed, the sensor and cable sensor connectors are NOT water-proof. Do not submerge the cable without a sensor or port plug installed in all available ports.*
>
> *When the cable is disconnected, the cable's instrument connector and the connector on the instrument maintain an IP-67 rating.*

SENSOR STORAGE

The cable assembly is supplied with a storage container, or sleeve, that installs on to the cable. The container is used for short-term storage (less than 30 days). Be sure to keep a small amount of moisture (tap water) in the container during storage. This is done to maintain a 100% saturated air environment which is ideal for short-term sensor storage (see Care, Maintenance, and Storage for more detailed information). Do not submerge the sensors in an aqueous solution. The intent is to create a humid air storage environment.

KEYPAD

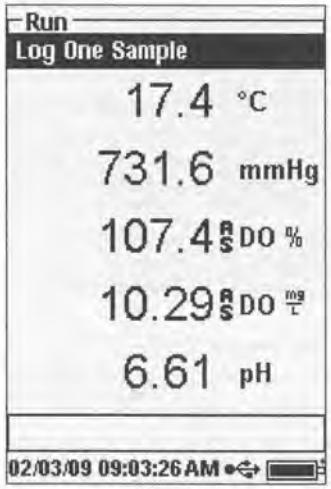


Number	*Key*	*Description*
1		**System** Opens System Menu from any screen. Use to adjust system settings.
2		**Sensor** Opens Sensor Menu from any screen. Use to enable sensors and display units.
3	Cal	**Calibrate** Opens Calibrate Menu from any screen. Use to calibrate all parameters except temperature.
4		**File** Opens File Menu from any screen. Use to view data and GLP files, set up site and folder lists, and delete data.
5		**Backlight** Press to turn the instrument backlight on and off and to adjust the display contrast when pressed with the left or right arrow key.

Number	Key	Description
6		**Right Arrow** Use to navigate right in alpha/numeric entry screens. Can be pressed simultaneously with Backlight key to increase display contrast.
7		**Down Arrow** Use to navigate through menus and to navigate down in alpha/numeric entry screens.
8		**Power** Press to turn the instrument on. Press and hold for 3 seconds to turn off.
9		**Help** Press to receive hints & tips during operation.
10		**Enter** Press to confirm selections, including alpha/numeric key selections.
11		**Left Arrow** Use to navigate left in alpha/numeric entry screens. Press to return to previous menu in all screens except alpha/numeric entry. Can be pressed simultaneously with Backlight key to decrease display contrast.
12		**Exit/Escape** Exits back to Run Screen. When in alpha/numeric entry screen, escapes to previous menu.
13		**Up Arrow** Use to navigate through menus and to navigate up in alpha/numeric entry screens.

MAIN DISPLAY

Press the Power key to turn the instrument on. The instrument will briefly display the splash screen with the YSI logo then go directly to the main run screen. The first time the instrument is powered up or if the instrument has had a battery change (with batteries removed for more than 2 minutes), you will need to set the date and time. Follow the instructions under **System Menu | Date/Time**.



The display at the left shows the run mode (main display) with temperature in °C, barometer in mmHg, DO in % and mg/L, and pH as the reported parameters. The date, time and battery level are indicated at the bottom of the screen. The logging preference of Log One Sample at a time is indicated at the top of the screen.

This screen also shows the message line towards the bottom of the display above the date and time. In this case, it doesn't show a message but messages will appear frequently to indicate calibration steps, set date and time, etc.

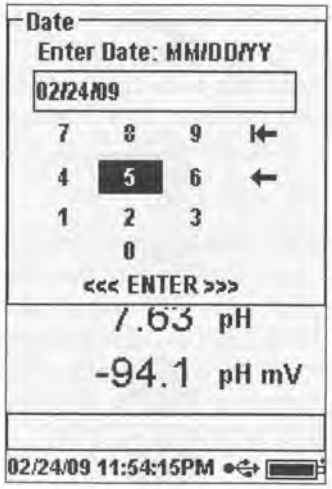
A USB symbol will show up on the bottom of the display when connected to a PC through USB with the communications saddle. The instrument will display full battery power when it is receiving power through the USB connection.

> ***Contrast** – the contrast adjustment can be accomplished by pressing the backlight key and the left or right arrow key at the same time.*

MENU LAYOUT

Press Esc at anytime in the menus to escape back to the Run screen. The left arrow can be used to go back to the previous menu in all screens except alpha/numeric entry screens. You must use Esc to get out of the alpha/numeric screens if you want to exit before finishing or without saving changes. Functions that are enabled appear as a circle with a dot ⊙ or a box with a check mark ☑. Disabled functions appear as a circle only ○ or an empty ☐.

ALPHA/NUMERIC ENTRY



The numeric screens will display numbers only (shown on the left). Alpha/numeric screens will display numbers across the top and letters along the bottom rows (shown on the right). Letters appear as a common keyboard arrangement.

When an alpha or numeric character is required, the screen will show the alpha/numeric entry screen. To select a character, highlight it by using the arrow keys to move the highlight box over the desired selection. Then, press **Enter** on the keypad to confirm the selection. After confirming the selection, it will appear in the line at the top of the display.

For capital letters or lower case entry, highlight "SHIFT" and press **Enter** on the keypad to change the characters from upper to lower case.

To delete the entire line of the current entry, highlight ⇤ and press **Enter** on the keypad. The ← symbol functions as a backspace key in the alpha/numeric entry screens by deleting one character at a time. Use the "SPACE" function to add a space between characters.

When you have finished entering the correct information (16 character max), highlight <<<ENTER>>> at the bottom of the screen and press **Enter** on the keypad to confirm.

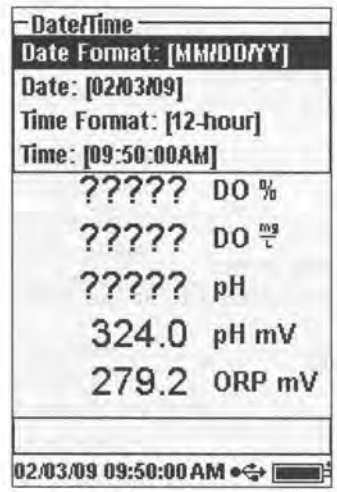
> *The ◀ key cannot be used to escape to the previous menu from an alpha/numeric entry screen. Instead, use the Esc key to go back to the previous menu when in alpha/numeric entry screens.*

SYSTEM MENU

Press System to access any of the following menu items.

The System menu will allow you to access the setup options of the instrument including; **Date/Time**, **GLP**, **Language**, **Radix Point**, **Logging**, **Auto-Shutoff**, **Backlight**, **SW** (Software) **Version**, **Serial #**, and **Unit ID**. Any item with [brackets] shows the current setting inside the brackets. For instance, in the example at the left, Radix Point is currently set to [Decimal]. The brackets will also give a quick visual clue as to what items can be changed.

DATE/TIME



Highlight **Date/Time** from the **System** menu. Press enter to select.

Date Format – Highlight and press enter to open a sub menu for selecting the preferred date format: YY/MM/DD, MM/DD/YY, DD/MM/YY, or YY/DD/MM.

Date – Highlight and press enter to use the numeric entry screen to set the correct date.

Time Format – Highlight and press enter to open a submenu to select the preferred time format from 12-hour or 24-hour.

Time – Highlight and press enter to use the numeric entry screen to set the correct time.

> *The date and time will need to be reset if a battery change takes longer than 2 minutes. When this occurs, the Date/Time menu will automatically appear upon power up and require you to set the date and time.*

GLP

The GLP or 'Good Laboratory Practice' file saves detailed information about calibrations. It also includes diagnostic information about the sensors. Calibrations are logged into a file, the GLP, for later review as needed. A single GLP file is utilized to store all calibration records and is capable of storing 500 records. Once the GLP file is full, the instrument will begin to overwrite the oldest record with each new calibration record.

> ⓘ *In order to keep all of your GLP records, periodically download the GLP to Data Manager and export it to another program. Otherwise, the unit will overwrite the oldest record once the memory is full. Also, since Data Manager saves GLP files under the Unit ID, you must periodically export and rename the GLP file on your PC or it will be overwritten each time you upload the GLP file from the instrument.*

Several calibration parameters are saved for each calibration record including optional ones that can be enabled by the user. Standard parameters include date/time stamp, calibration method, and sensor information. Optional, user selectable parameters include User ID, Probe ID, and User Fields 1 and 2.

The sensor specific information that is saved with each calibration point is different for each sensor. The sensor specific values saved are:

Conductivity
Method (Spec Cond, Cond, Salinity)
Cal Value (value of calibration solution)
Sensor Value (Cell Constant)
Temperature Reference (User selected in Sensor Setup menu)
Temperature Compensation Coefficient %/°C (User selected in Sensor Setup menu)
TDS Constant (User selected in Sensor Setup menu)
Temperature
Cal Cell Constant
Calibrate Status

DO
Method (%, mg/L)
Cal Value
Sensor Value (Sensor Current)
Sensor Type (Polarographic/Galvanic)
Membrane Type (Teflon Black, PE Yellow, PE Blue)
Salinity Mode (user entered value if in Manual Salinity Mode)
Temperature
Barometer
Calibrate Status

pH (up to 6 calibration points)
Buffer Value
Sensor Value (mV)
Temperature
Slope (mV/pH)
Slope (% of ideal)
Calibrate Status

ORP
Cal Solution Value
Sensor Value
Temperature
Calibrate Status

Ammonium
Buffer Value
Sensor Value (mV)
Temperature
Calibrate Status

Chloride
Buffer Value
Sensor Value (mV)
Temperature
Calibrate Status

Nitrate
Buffer Value
Sensor Value (mV)
Temperature
Calibrate Status

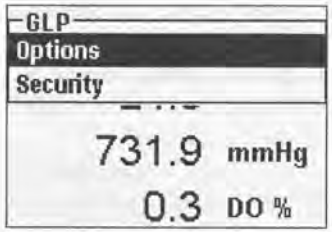
An example of a GLP record

(Operation performed is single point % DO Calibration)

*** Calibrate – DO% ***

Date	02/03/09 MM/DD/YY
Time	12:14:57PM 12-hour
User ID:	Tech 1
Probe ID	08D
Method	DO Air Calibrate
Cal Value:	100.00%
Sensor Value:	5.175155uA
Sensor Type	Polarographic
Membrane Type	1.25 PE Yellow
Salinity Mode	5.175165 Auto
Temperature	23.9 °C
Barometer	731.4 mmHg
Calibrate Status	Calibrated

GLP SETTINGS



In the System menu, highlight **GLP** and press enter to view and modify the GLP settings.

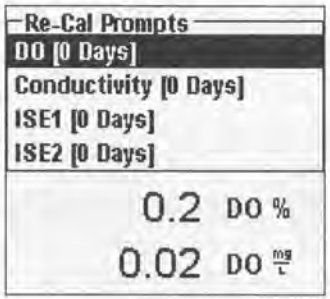
Highlight Options and press enter to access **User ID**, **Probe ID**, **User Defined Fields**, and **Re-Cal Prompt**.

User ID may be used to identify the person calibrating the instrument. Highlight **User ID** and press enter to select, edit, or delete a User ID from a list of previously entered IDs. Or, highlight **Add New** and press enter to create a new User ID using the alpha/numeric entry screen. The User ID may also be changed in the **Calibration** menu during the calibration process. The selected User ID will be stored in the GLP file with each calibration record. A User ID could be a person's initials or badge number. The character limit is 16 characters.

Probe ID is stored with the calibration record and may be used to distinguish one cable/probe

assembly from another, typically by serial number. Highlight **Include Probe ID** and press enter to turn this function on (☑) and off (☐). Highlight **Probe ID** and press enter to add, view, edit, delete, or select a Probe ID. The Probe ID may also be changed in the **Calibration** menu during the calibration process. The character limit is 16 characters.

User Fields 1 and 2 are stored with the calibration record and may be used to enter other parameters pertinent to the user, such as weather conditions, elevation, etc. Highlight **Include User Field 1** or **Include User Field 2** and press enter to turn this function on and off. Highlight **User Field 1** or **User Field 2** and press enter to add, delete, view, edit, or select a User Field. The character limit is 16 characters. When enabled, a prompt for selecting a User Defined Field will appear during the calibration process.



Re-Cal Prompt may be used to remind the user to perform a calibration. To set a time interval, highlight the parameter you wish to be reminded about and press enter to access the numeric entry screen. Enter a value in days and press enter to confirm the reminder time. To turn off the Re-cal prompt, set the reminder to zero (0) days (this is the default).

The **Security** section of the GLP menu is a password protected area. This area includes options to set a new password and to lock access to the calibration menu. When first viewing the security menu, you will be required to enter a password. Use the "shift" on the alpha/numeric screen to switch to lower case if necessary and enter "**ysi123**". This is the default password.

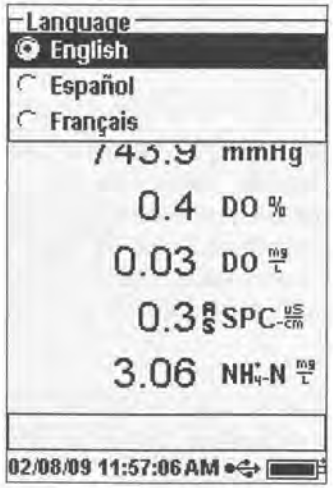
Protect Cal can be enabled (☑) or disabled (☐). When enabled, the user must know and enter the instrument's password to enter the calibration menu option. Highlight **Protect Cal** and press enter to enable or disable this feature.

Set Password allows a user to set the security password. Highlight **Set Password,** press enter, and use the alpha/numeric entry screen to set the new password. The password can have up to 16 characters.

Contact YSI Technical Support at environmental@ysi.com or +1 937 767-7241 if you forget or misplace your password.

> ⓘ *Once a password is set, and the GLP security screen exited, a password must be entered to make changes under GLP security. Keep passwords in a safe place.*

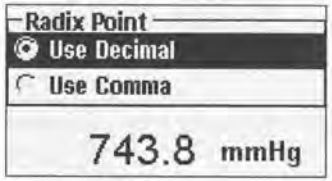
LANGUAGE



The Pro Plus can be configured to display all text in English, Spanish, French, German, Portuguese, Italian, Norwegian, Simplified Chinese, Traditional Chinese, or Japanese. From the factory, the instrument includes English, Spanish, and French language options. The other language options can be downloaded from www.ysi.com/support.

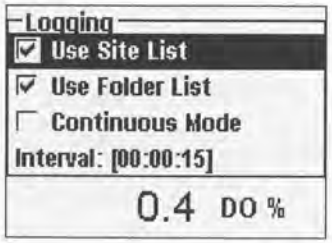
Once the appropriate language file is in the instrument, press System, highlight **Language,** and press enter. Highlight the desired language and press enter to confirm.

RADIX POINT



Radix Point allows the user the option to choose between a comma or a decimal in numeric displays. For example, 1.00 becomes 1,00 when **Use Comma** is selected. Highlight **Use Decimal** or **Use Comma** and press enter to make your selection.

LOGGING



From the System menu, highlight **Logging** and press enter to view or change the logging options. Logging options include **Use Site List, Use Folder List, Continuous Mode**, and **Interval**.

Use Site List and **Use Folder List** are optional ways of filing or 'tagging' your logged data points. If these settings are enabled, you will be prompted to select a Site and/or Folder to 'tag' to the logged data point. See the **File and Site Lists** section of this manual for information on creating Site and Folder Lists.

Check the box for **Continuous Mode** if you want to log samples continuously at a specific time interval. To set the length of time between logged samples, highlight **Interval** and press enter. Enter the interval as HH:MM:SS. This interval will display at the top of the screen when you select the **Start Logging** option in run mode.

To log one sample at a time, uncheck **Continuous Mode.** When Continuous Mode is unchecked, **Log One Sample** will appear at the top of the run screen.

AUTO SHUTOFF

Auto Shutoff powers the instrument off after a user specified time period. Highlight **Auto Shutoff** and press enter. Using the alpha/numeric entry screen, enter a value between 0 and 360 minutes. To disable auto shutoff, set the value to 0 (zero).

BACKLIGHT

Backlight can be set to **Automatic** or **Manual.** Automatic turns the backlight on when you turn the instrument on and when you press any key. Manual allows you to turn the backlight on or off with the backlight key. When in Automatic mode, the instrument will turn the backlight off 60 seconds after the last key press. The instrument will "reset" the 60 second time period every time a key is pressed. The lighted keypad will turn off after approximately 20 seconds.

SW VERSION (SOFTWARE VERSION)

SW Version shows the instrument's software version. The instrument's software can be updated via www.ysi.com/support. There you will find the new software files and instructions on how to update the instrument. There is no need to send the instrument back to the factory for upgrades.

SERIAL

Serial # shows the instrument's serial number and allows you to match it with the number engraved on the back of the instrument's case.

UNIT ID

Unit ID is used to identify instruments in the Data Manager software program that was included with your instrument. It is also used to identify GLP files, Site Lists, Configuration files, and Data files transferred from the instrument to the PC. The default Unit ID is the instrument's serial number. To modify the Unit ID, highlight **Unit ID**, press enter and then use the alpha/numeric entry screen. The character limit is 16 characters.

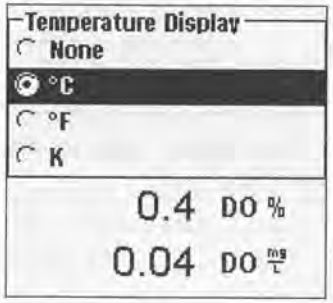
PARAMETERS: SETUP, DISPLAY, AUTO STABLE, AND CALIBRATION

The following section is separated by parameter and will discuss sensor setup, display options, auto stable features, and calibration procedures for each parameter. The sections are separated by parameter due to the versatility of the Pro Plus. You may focus solely on the parameters of your choice.

For the highest accuracy, calibrate or verify each sensor regularly. For your convenience, YSI offers 5580 Confidence Solution® which allows you to check the accuracy of pH, conductivity, and ORP readings to help determine if a sensor calibration is necessary.

If you receive an error message during a calibration that indicates questionable results, you have the option to either accept or decline the calibration. YSI recommends that you decline a questionable calibration since accepting it may result in erroneous data. After declining a questionable calibration, ensure the sensor is clean, the calibration solution is good, the calibration vessel is clean, and that you are entering the correct calibration value if entering manually. Then, try to recalibrate the sensor. If you continue to have problems, see the Troubleshooting section of this manual.

TEMPERATURE



All probe/cable assemblies, except the Quatro, have a built-in temperature sensor. The Quatro cable ships with a Conductivity/Temperature sensor that must be installed on the cable. Temperature calibration is not required nor is it available.

To set the units, press Sensor, highlight **Display** and press enter. Highlight **Temperature** and press enter. Highlight the desired temperature units of °F, °C, or K and press enter to confirm the selection. Only one temperature unit may be displayed at a time. You may also choose not to display temperature. If you choose not to display temperature, other parameters that require a temperature reading will still be temperature compensated.

DISSOLVED OXYGEN (DO)

DO sensors can be used on 60520-X, 6051020-X, 6052030-X, and Quatro cables.

PREPARING THE DO SENSOR FOR THE FIRST TIME

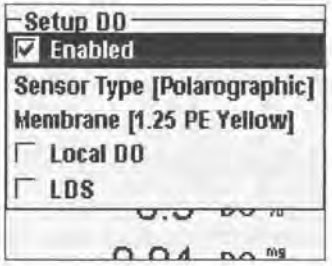
The dissolved oxygen sensor is shipped with a dry, protective red cap that will need to be removed before using. It is very important to put a new membrane with electrolyte solution on the sensor after removing the red cap.

Prepare the membrane solution according to the instructions on the bottle. After mixing, allow the solution to sit for 1 hour. This will help prevent air bubbles from later developing under the membrane. Ensure you are using the correct electrolyte solution for the correct sensor. Galvanic sensors utilize electrolyte with a light blue label and Polarographic sensors utilize electrolyte with a white label. The dissolved oxygen sensor is supplied with cap membranes specific to the sensor type ordered (Polarographic or Galvanic). 5912, 5913, and 5914 membrane kits are for Galvanic sensors and the 5906, 5908, and 5909 membrane kits are for Polarographic sensors. See the **Setup - Dissolved Oxygen** section of this manual for more information on the different types of membranes available from YSI.

Remove the red cap by pulling it straight off the sensor tip. Discard or save for later use during long term storage. Thoroughly rinse the sensor tip with distilled or deionized water. Fill the cap membrane 3/4 full of electrolyte solution, then tap the cap with a finger to release any trapped air. Be careful not to touch the membrane portion of the cap. Thread the membrane cap onto the sensor, moderately tight. Do not use a tool. It's typical for some of the electrolyte solution to spill over. For detailed instructions on changing a membrane cap, see the **Care, Maintenance, and Storage** section of this manual.

SETUP - DISSOLVED OXYGEN

Press Sensor, highlight **Setup** and press enter. Next, highlight **DO** and press enter.



Enabled allows you to enable or disable the Dissolved Oxygen function. Highlight **Enabled** and press enter to activate(☑) or deactivate(☐) dissolved oxygen. Disable dissolved oxygen if you do not have a dissolved oxygen sensor connected to the instrument.

> *If a sensor is Enabled that isn't connected to the instrument, the display will show an unstable, false reading, ?????, or ----- next to the units.*

Sensor Type sets the type of oxygen sensor being used: either Polarographic (black) or Galvanic (grey). Highlight **Sensor Type** and press enter. Highlight the correct sensor type installed on the cable and press enter to confirm.

If using a ProBOD sensor/cable assembly, the sensor type should be set to polarographic.

The Pro Plus has two compatible sensors for use with a field cable:

Polarographic – This sensor has a black sensor body and is engraved with the model number 2003.

Galvanic – This sensor has a grey sensor body and is engraved with the model number 2002.

In terms of physical configuration, membrane material, and general performance, YSI Professional Series Galvanic dissolved oxygen sensors are exactly like the Professional Series Polarographic sensors. The advantage of using Galvanic sensors is convenience. Galvanic sensors provide for an instant-on sensor without the need for warm-up time but this affects the life of the sensor. Polarographic sensors last longer and have a longer warranty but require a 5-15 minute warm-up time before use or calibration.

> **IMPORTANT** – *The instrument default setting is Galvanic. Please change the **Sensor Type** to match the correct sensor. If you observe readings very close to 0 or extremely high readings (i.e. 600%), your **Sensor Type** setting (Polarographic or Galvanic) may be set incorrectly and you should immediately ensure it matches the sensor installed on your cable.*

Membrane sets the type of membrane used on the dissolved oxygen sensor. Highlight **Membrane** and press enter. Highlight the correct membrane type installed on the sensor and press enter to confirm. The DO sensor is supplied with membranes specific to the sensor type ordered and are color coded as described in the following tables.

Galvanic membrane kits:

Item	*Color*	*Material*	*Description*
5912	Black	1 mil Teflon®	Traditional membrane material
5913	Yellow	1.25 mil polyethylene	Improved response time and less flow dependence than Teflon® Ships standard with the sensor.
5914	Blue	2 mil polyethylene	Less flow dependence than 1.25 mil but somewhat slower response

Polarographic membrane kits:

Item	*Color*	*Material*	*Description*
5906	Black	1 mil Teflon®	Traditional membrane material
5908	Yellow	1.25 mil polyethylene	Improved response time and less flow dependence than Teflon® Ships standard with the sensor.
5909	Blue	2 mil polyethylene	Less flow dependence than 1.25 mil but somewhat slower response

Selecting a Dissolved Oxygen Membrane:

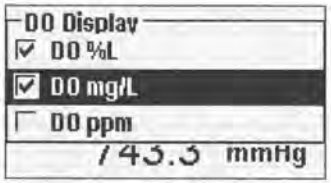
Membrane Type	*Flow Dependence After 4 Minutes*	*Typical Response Time - 95%*
5912, 5906 - Black	60%	18 seconds
5913, 5908 - Yellow	25%	8 seconds
5914, 5909 - Blue	18%	17 seconds

Local DO allows for localized DO% measurements. This sets the calibration value to 100% regardless of the altitude or barometric pressure. Highlight **Local DO** and press enter to enable (☑) or disable (☐) this function. Local DO is a method for the Pro Plus to factor in the barometric pressure on each DO measurement. In essence, if the barometric pressure changes you wouldn't notice the difference in the DO% readings in air-saturated water or water-saturated air. Local DO is ideal for EU compliance. When Local DO is enabled, an L will appear next to DO% on the run screen. DO mg/L readings are unaffected by the selection of DO Local.

LDS (Last Digit Suppression) rounds the DO value to the nearest tenth; i.e. 8.27 mg/L becomes 8.3 mg/L. Highlight **LDS** and press enter to enable (☑) or disable (☐) this function.

DISPLAY - DISSOLVED OXYGEN

Press Sensor, highlight **Display** and press enter. Highlight **DO** and press enter. All DO units can be displayed simultaneously. Highlight the unit(s) and press enter to activate (☑) or deactivate (☐) units from the run screen. Note - You will not be able to display dissolved oxygen unless it is **Enabled** in the Sensor Setup menu first, see previous section.



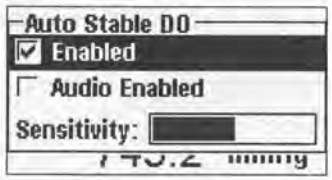
DO % will show DO readings in a percent scale from 0 to 500%.

DO mg/L will show DO readings in milligrams per liter (equivalent to ppm) on a scale from 0 to 50 mg/L.

DO ppm will show DO readings in parts per million (equivalent to mg/L) on a scale from 0 to 50 ppm.

AUTO STABLE - DISSOLVED OXYGEN

Auto Stable indicates when a reading is stable.When Auto Stable is enabled, **AS** will blink next to the parameter until it is stable. Once the parameter is stable, **AS** will stop blinking.



To enable Auto Stable, press Sensor, highlight **Auto Stable** and press enter. Highlight **DO** and press enter.

Highlight **Enabled** and/or **Audio Enabled** (instrument will beep when the stability

is achieved) and press enter to confirm. The Auto Stable **Sensitivity** can be decreased or increased. Highlight **Sensitivity** and use the left and right arrow keys to slide the bar. The more sensitive you make it (larger black bar) the harder it is to achieve stability in a changing environment.

The **Auto Stable** system works by examining the previous 5 readings, computing the percent change in the data and comparing that change against a % threshold value. The % threshold value is determined by the **Sensitivity** bar setting. The following chart can be used as a guide when setting the Sensitivity bar.

Sensitivity selected by User	*% Data Variance Threshold*
100 - Most Sensitive, Sensitivity bar is set to the far right	0.05%
75	0.62525%
50	1.275%
25	1.8875%
0 - Least Sensitive, Sensitivity bar is set to the far left	2.5%

Example:

The instrument obtained the following data:

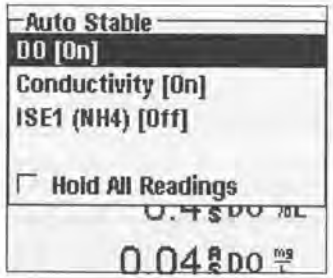
Reading #1 95.5 DO%
Reading #2 95.7 DO%
Reading #3 95.8 DO%
Reading #4 96.1 DO%
Reading #5 95.3 DO%

The instrument is programmed to determine the minimum and maximum data value over the previous 5 samples, and to compute the percent difference between those values. In this example, that gives a percent change of:

% Change = 100 * ((96.1 – 95.3) / 95.3)
% Change = 0.83%

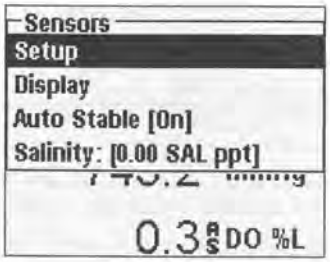
In this example, if the Sensitivity bar is set to the far right, the Auto Stable requirement would not be met and AS would continue to blink. However, if the sensitivity bar is set to the median threshold (1.275%), the Auto Stable requirement would be met and AS would display steadily on the display.

Within the Auto Stable menu, you can also choose to **Hold All Readings** for as many parameters as you set for Auto Stable. For instance, if DO and pH have



Auto Stable and Hold All Readings enabled, then the display will hold the readings once DO and pH have both reached their Auto Stable settings. You must press the **Esc** key to "release" the held display in order to take subsequent readings **Hold All Readings** must be reactivated after each use!

SALINITY CORRECTION



The last feature in the **Sensor** menu is the **Salinity** correction value which is used to calculate the dissolved oxygen mg/L and ammonia readings when a conductivity sensor is not in use. Press Sensor, highlight **Salinity**, and press enter. Then, use the numeric entry screen to enter the Salinity value of the water you will be testing from 0 to 70 ppt.

If using a cable with a conductivity sensor, the salinity measured by the conductivity sensor will be used in the DO and ammonia mg/L calculations and 'As Measured' will be displayed next to **Salinity** in the Sensor menu.

As the salinity of water increases, its ability to dissolve oxygen decreases. For example, fully oxygenated 20 °C water at sea level with zero salinity will hold 9.092 mg/L of dissolved oxygen. If that same sample had a salinity value of 9 ppt, then it would hold 8.621 mg/L of dissolved oxygen. Therefore, to obtain accurate mg/L readings, it is important to know the salinity of the water you will be testing and to input that value into the instrument. The salinity of fresh water is typically 0-0.5 ppt and seawater is typically 35 ppt. You will also have the opportunity to enter or modify the Salinity correction value during DO calibration.

CALIBRATION - DISSOLVED OXYGEN

The Pro Plus offers several options for calibrating dissolved oxygen: DO% in water saturated air, DO mg/L and DO ppm in a solution of known dissolved oxygen determined by a Winkler Titration, and a Zero point. If performing a zero point calibration, you must also perform a %, mg/L, or ppm calibration following the zero calibration. For both ease of use and accuracy, YSI recommends performing the following 1-point DO % water saturated air calibration:

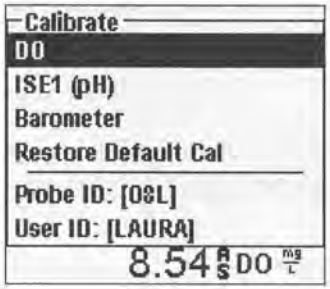
> *It is not necessary to calibrate in both % and mg/L or ppm. Calibrating in % will simultaneously calibrate mg/L and ppm and vice versa.*

Calibrating DO % in Water Saturated Air:
1-Point Calibration

The supplied sensor storage container (a grey sleeve for a single port cable or a screw on plastic cup for the dual-port and Quatro cables) can be used for DO calibration purposes.

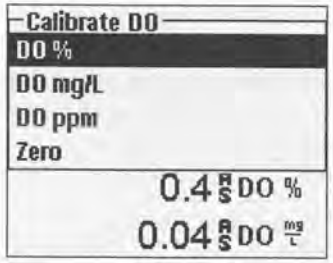
Moisten the sponge in the storage sleeve or plastic cup with a small amount of clean water. The sponge should be clean since bacterial growth may consume oxygen and interfere with the calibration. If using the cup and you no longer have the sponge, place a small amount of clean water (1/8 inch) in the plastic storage cup instead.

Make sure there are no water droplets on the DO membrane or temperature sensor. Then install the storage sleeve or cup over the sensors. The storage sleeve ensures venting to the atmosphere. If using the cup, screw it on the cable and then disengage one or two threads to ensure atmospheric venting. Make sure the DO and temperature sensors are not immersed in water. Turn the instrument on and wait approximately 5 to 15 minutes for the storage container to become completely saturated and to allow the sensors to stabilize.



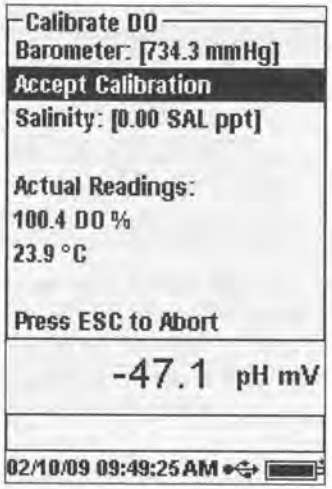
Press Cal. Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. User ID will appear automatically. Select 'None' if you do not want a User ID stored with the calibration. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting your User ID and/or Probe ID if appropriate, highlight DO and press enter.



Highlight **DO %** and press enter to confirm.

The instrument will use the internal barometer during calibration and will display this value in brackets at the top of the display. Highlight **Barometer** and press enter to adjust it if needed. If the barometer reading is incorrect, it is recommended that you calibrate the barometer. Note - the barometer should be reading "true" barometric pressure (see Barometer section for more information on "true" barometric pressure). If the value is acceptable, there is no need to change it or perform a barometer calibration.



The Salinity value displayed near the top of the screen is either the salinity correction value entered in the Sensor menu or the Salinity value as measured by the conductivity sensor in use and enabled. If you are not using a conductivity sensor, the Salinity correction value should be the salinity of the water you will be testing. Highlight **Salinity** and press enter to modify this setting if necessary. See the **Salinity Correction** section of this manual for more information.

Wait for the temperature and DO% values under "Actual Readings" to stabilize, then highlight **Accept Calibration** and press enter to calibrate. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled in the GLP menu, you will be prompted to select these inputs and then press Cal to complete the calibration. The message line at the bottom of the screen will display "Calibrating Channel..." and then "Saving Configuration...".

Calibrating DO% in Water Saturated Air:
2-Point Calibration with Zero Solution

Place the sensor in a solution of zero DO.

A zero DO solution can be made by dissolving approximately 8 - 10 grams of sodium sulfite (Na_2SO_3) into 500 mL tap water or DI water. Mix the solution thoroughly. It may take the solution 60 minutes to be oxygen-free.

Press Cal. Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight DO and press enter. Highlight **Zero** and press enter. Wait for the temperature and DO% values under "Actual Readings" to stabilize, then press enter to **Accept Calibration**. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal to complete the calibration. The screen will then prompt for a follow-up second point calibration.

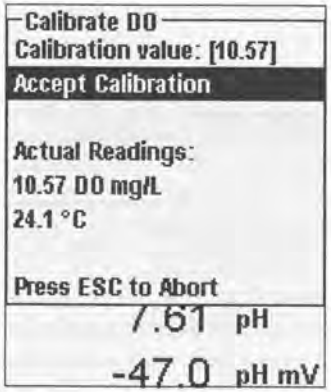
Highlight **DO%** and press enter to continue with the next calibration point. Rinse the sensor of any zero oxygen solution using clean water. Then follow the steps under Calibrating DO % in Water Saturated Air to complete the second point.

Calibrating in mg/L or ppm as a Titration:
1-Point Calibration

Place the sensor into an adequately stirred sample that has been titrated to determine the dissolved oxygen concentration. Allow the sensor to stabilize.

Press Cal. Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight DO and press enter. Highlight **DO mg/L or ppm** and press enter.



Highlight **Calibration value** and press enter to manually input the sample's dissolved oxygen value. Highlight **Accept Calibration** and press enter once the temperature and Dissolved Oxygen readings stabilize. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled in the GLP menu, you will be prompted to select the fields after selecting **Accept Calibration**. After making your selection, press Cal to complete the calibration. After completing the calibration, the message line will display "Calibrating Channel..." and then "Saving Configuration...".

Calibrating in mg/L or ppm as a Titration:
2-Point Calibration with Zero Solution

Place the sensor in a solution of zero DO.

A zero DO solution can be made by dissolving approximately 8 - 10 grams of sodium sulfite (Na_2SO_3) into 500 mL tap water. Mix the solution thoroughly. It may take the solution 60 minutes to be oxygen-free.

Press Cal. Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting the Probe ID and/or User ID if appropriate, highlight DO and press enter. Highlight **Zero** and press enter. Wait for the temperature and DO% values under "Actual Readings" to stabilize, then press enter to **Accept Calibration**. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then Press Cal to complete the calibration. The screen will then prompt for a follow-up second point calibration.

Highlight the desired calibration units (mg/L or ppm) and press enter to continue with the next point. Rinse the sensor of any zero oxygen solution using clean water. To complete the second calibration point, follow the steps under Calibrating in mg/L or ppm as a Titration: **1-Point Calibration**.

BAROMETER

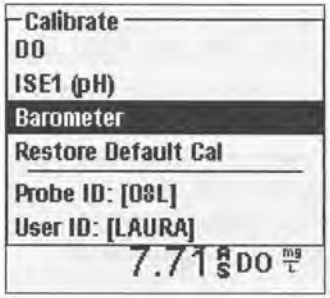
All Professional Plus instruments contain an internal barometer.

DISPLAY - BAROMETER

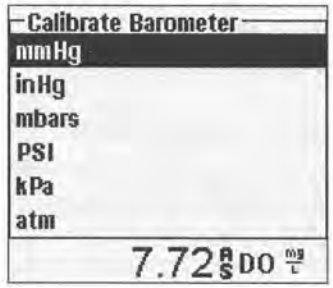
Press Sensor, highlight **Display** and press enter. Highlight **Barometer** and press enter. The measurement unit options are: mmHg, inHg, mBar, PSI, kPa, or Atm. Only one unit can be displayed at a time. Select **None** if you do not want to display a barometric pressure reading.

Whether or not you choose to display the barometer reading, the barometric pressure will still be used for calibrating DO% and for compensating for pressure changes if **Local DO** is enabled.

CALIBRATION - BAROMETER

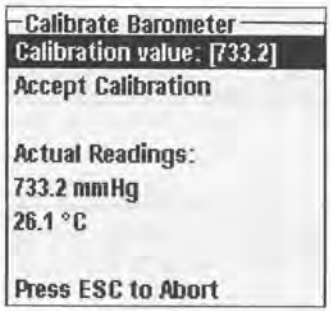


The barometer in the instrument is calibrated at the factory. If the barometer requires calibration, press **Cal**. Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. When enabled, these IDs are stored with each calibration record in the GLP file.



After selecting the Probe ID and/or User ID if appropriate, highlight **Barometer** and press enter.

Highlight the desired unit and press enter.



Highlight **Calibration Value** and press enter to manually enter the correct "true" barometric pressure. Next, highlight **Accept Calibration**, and press enter. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal to complete the calibration or press Esc to cancel the calibration.

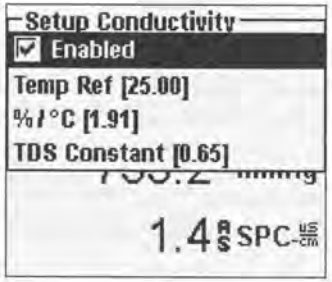
> *Laboratory barometer readings are usually "true" (uncorrected) values of air pressure and can be used "as is" for barometer calibration. Weather service readings are usually not "true", i.e., they are corrected to sea level, and therefore cannot be used until they are "uncorrected". An approximate formula for this "uncorrection" is below:*

True BP = [Corrected BP] – [2.5 * (Local Altitude in ft. above sea level/100)]

CONDUCTIVITY

Conductivity sensors are supplied with 60530-X, 6051030-X, 6052030-X , and Quatro cables. Conductivity sensors are built into the 60530-X, 6051030-X, and 6052030-X cables and are not replaceable. Conductivity/Temperature sensors are shipped with the Quatro cable, must be installed, and are replaceable.

SETUP - CONDUCTIVITY



Press Sensor , highlight **Setup,** and press enter. Highlight **Conductivity**, press enter.

Enabled allows you to enable or disable the conductivity measurement. Highlight **Enabled** and press enter to activate (☑) or deactivate (☐) conductivity. Disable conductivity if you do not have a conductivity sensor connected to the instrument.

> *If a sensor is Enabled that isn't connected to the instrument, the display will show an unstable, false reading next to the units.*

Temp Ref (Temperature Reference) is the reference temperature used for calculating temperature compensated Specific Conductance. This will be the

temperature all Specific Conductance values are compensated to. The default is 25 °C. To change the Reference Temperature, highlight **Temp Ref** and press enter. Use the numeric entry screen to enter a new value between 15.00 and 25.00 °C. Next, highlight <<<ENTER>>> at the bottom of the screen and press enter on the keypad to confirm.

%/°C (Percent per Degree Celsius) is the temperature coefficient used to calculate temperature compensated Specific Conductance. The default is 1.91% which is based on KCl standards. To change the temperature coefficient, highlight %/°C and press enter. Use the numeric entry screen to enter a new value between 0 and 4%. Next, highlight <<<ENTER>>> at the bottom of the screen and press **Enter** on the keypad to confirm.

TDS Constant is a multiplier used to calculate an estimated TDS (Total Dissolved Solids) value from conductivity. The multiplier is used to convert Specific Conductance in mS/cm to TDS in g/L. The default value is 0.65. This multiplier is highly dependent on the nature of the ionic species present in the water sample. To be assured of moderate accuracy for the conversion, you must determine a multiplier for the water at your sampling site. Use the following procedure to determine the multiplier for a specific sample:

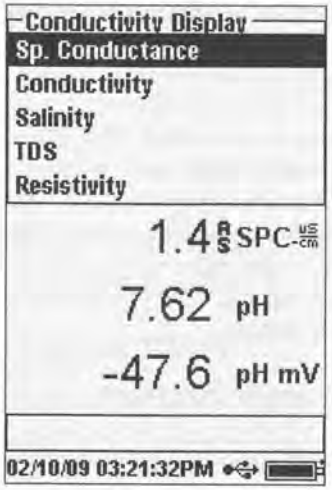
1. Determine the specific conductance of a water sample from the site;
2. Filter a portion of water from the site;
3. Completely evaporate the water from a carefully measured volume of the filtered sample to yield a dry solid;
4. Accurately weigh the remaining solid;
5. Divide the weight of the solid (in grams) by the volume of water used (in liters) to yield the TDS value in g/L for this site; Divide the TDS value in g/L by the specific conductance of the water in mS/cm to yield the conversion multiplier. Be certain to use the correct units.

> *If the nature of the ionic species at the site changes between sampling studies, the TDS values will be in error. TDS cannot be calculated accurately from specific conductance unless the make-up of the chemical species in the water remains constant.*

To change the multiplier, highlight **TDS Constant** and press enter. Use the numeric entry screen to enter a new value between 0 and 0.99. Highlight <<<ENTER>>> at the bottom of the screen and press **Enter** on the keypad to confirm.

DISPLAY - CONDUCTIVITY

Press Sensor ❶, highlight **Display** and press enter. Highlight **Conductivity** and press enter. Highlight **Sp. Conductance** (Specific Conductance), **Conductivity**, **Salinity**, **TDS**, or **Resistivity**, and press enter to select the reporting units for each parameter. One reporting unit per parameter may be enabled. To disable a parameter, select **None**. You will not be able to display any of these parameters unless the Conductivity sensor is **Enabled** in the Sensor Setup menu first.



Sp. Conductance can be displayed in us/cm or ms/cm. Specific conductance is temperature compensated conductivity.

Conductivity can be displayed in uS/cm or mS/cm. Conductivity is the measure of a solution's ability to conduct an electrical current. Unlike specific conductance, conductivity is a direct reading without any temperature compensation.

Salinity can be displayed in ppt (parts per thousand) or PSU (practical salinity units). The units are equivalent as both use the Practical Salinity Scale for calculation.

TDS can be displayed in mg/L (milligrams per liter), g/L (grams per liter), or kg/L (kilograms per liter).

Resistivity can be displayed in ohm-cm (ohms per centimeter), kohm-cm (kilo ohms per centimeter), or Mohm-cm (mega ohms per centimeter).

AUTO STABLE - CONDUCTIVITY

Press Sensor ❶, highlight **Auto Stable** and press enter. Highlight **Conductivity** and press enter.

Auto Stable indicates when a reading is stable. Highlight **Enabled** and/or **Audio Enabled** (instrument will beep when the stability is achieved) and press enter enable (☑) or disable (☐). When Auto Stable is enabled, **AS** will blink next to the parameter until it is stable. Once the parameter is stable, **AS** will stop blinking.

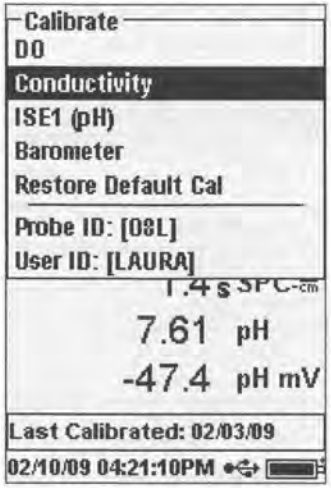
The Auto Stable **Sensitivity** can be decreased or increased. Highlight **Sensitivity** and use the left and right arrow keys to slide the bar. The more sensitive you make it (larger black bar) the harder it is to achieve stability in a changing environment.

The **Auto Stable** system works by examining the previous 5 readings, computing the percent change in the data and comparing that change against a % threshold value. The % threshold value is determined by the **Sensitivity** bar setting. The following chart can be used as a guide when setting the Sensitivity bar.

Sensitivity selected by User	*% Data Variance Threshold*
100 - Most Sensitive, Sensitivity bar is set to the far right	0.025%
75	0.39375%
50	0.7625%
25	1.13125%
0 - Least Sensitive, Sensitivity bar is set to the far left	1.5%

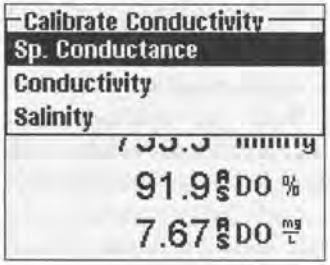
Within the Auto Stable menu, you can also choose to **Hold All Readings** for as many parameters as you set for Auto Stable. For instance, if conductivity and DO have Auto Stable and Hold All Readings enabled, then the display will hold the readings once conductivity and DO have both reached their Auto Stable settings. You must press the **Esc** key to "release" the held display in order to take subsequent readings. **Hold All Readings** must be reactivated after each use!

> *The 6051030 ISE/conductivity cable has a specialized calibration container that resembles a large test tube. This calibration chamber can be used to calibrate the conductivity sensor with an ISE sensor installed. A ring-stand should be used to support this chamber.*



Press Cal . Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. User ID will appear automatically. Select 'None' if you do not want a User ID stored with the calibration. When enabled, these IDs are stored with each calibration record in the GLP file.

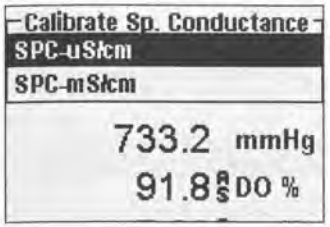
After selecting the User ID and/or Probe ID if appropriate, highlight **Conductivity** and press enter.



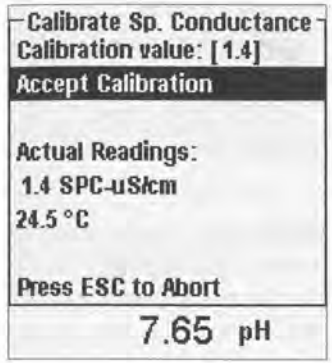
Highlight the desired calibration method; **Sp. Conductance**, **Conductivity**, or **Salinity** and press enter. YSI recommends calibrating in specific conductance for greatest ease.

Calibrating in Specific (Sp.) Conductance or Conductivity

Place the sensor into a fresh, traceable conductivity calibration solution. The solution must cover the holes of the conductivity sensor that are closest to the cable. Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately of half the expected value!



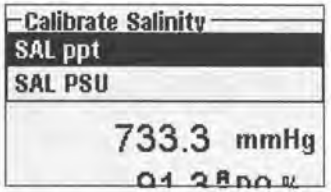
Choose the units in either **SPC-us/cm**, **C-us/cm** or **SPC-ms/cm**, **C-ms/cm** and press enter.



Highlight **Calibration value** and press enter to input the value of the calibration standard. Then, once the temperature and conductivity readings stabilize, highlight **Accept Calibration** and press enter. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled in the GLP menu, you will be prompted to select the fields and then press Cal to complete the calibration. After completing the calibration, the message line at the bottom of the screen will display "Calibrating Channel..." and then "Saving Configuration...".

Calibrating in Salinity

Place the sensor into a salinity calibration solution. The solution must cover the holes of the conductivity sensor that are closest to the cable. Ensure the entire conductivity sensor is submerged in the solution or the instrument will read approximately of half the expected value!



Select **SAL ppt** or **SAL PSU** and press enter.

Highlight **Calibration value** and press enter to input the value of the calibration standard. Then, once the temperature and conductivity readings stabilize, highlight **Accept Calibration** and press enter. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal to complete the calibration.

pH

pH sensors can be used on 60510-X, 6051020-X, 6051030-X, 6051010-X, and Quatro cables.

If using a 605103 pH/ORP combination sensor on a 6051020 or 6051030 cable you can report both pH and ORP by configuring ISE1 as pH and ISE2 as ORP in the Sensor Setup menu.

The 605103 pH/ORP combination sensor is not recommended for use on a 6051010 or Quatro cable. If used on one of these cable, only pH will be reported and ORP will not be measured.

SETUP - pH

Press Sensor, highlight **Setup**, press enter. Highlight **ISE1** if using a 60510, 6051020, or 6051030 cable. If using a 6051010 or Quatro cable, highlight **ISE1** if the pH sensor is installed in port 1 or highlight **ISE2** if the pH sensor is installed in port 2(a sensor must be installed in port 1 for port 2 to operate). Press enter.

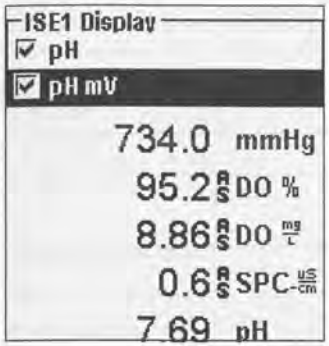
Enabled allows you to enable or disable the ISE function and select which ISE sensor is installed on the cable. Highlight **Enabled** and press enter to enable (☑) or disable (☐) the ISE you selected previously (either ISE1 or ISE2). Disable the ISE function(s) if you do not have a ISE sensor connected to the instrument.

After enabling the ISE function, ensure that it is set to pH as shown in the left screen shot. If necessary, highlight pH and press enter to set the ISE to pH.

Highlighting **pH[USA]** and pressing enter will also allow you to select the values for auto buffer recognition which are used during calibration. The buffer options are **USA** (4, 7, 10), **NIST** (4.01, 6.86, 9.18), and **User-Defined**. The selected option will be displayed in [brackets].

> ⓘ *If a sensor is Enabled that isn't connected to the instrument, the display will show an unstable false reading, ?????, or ----- next to the units.*

DISPLAY - pH



Press Sensor, highlight **Display** and press enter.

Highlight **ISE (pH)** and press enter. You will not be able to **Display** the sensor unless it is **Enabled** in the Sensor Setup menu.

Highlight **pH** and/or **pH mV**, press enter to enable (☑) or disable (☐). Both can be reported at the same time.

AUTO STABLE - pH

Press Sensor, highlight **Auto Stable** and press enter. Highlight **ISE (pH)** and press enter.

Auto Stable indicates when a reading is stable. Highlight **Enabled** and/or **Audio Enabled** (instrument will beep when the stability is achieved) and press enter enable (☑) or disable (☐). When Auto Stable is enabled, **AS** will blink next to the parameter until it is stable. Once the parameter is stable, **AS** will stop blinking.

The Auto Stable **Sensitivity** can be decreased or increased. Highlight **Sensitivity** and use the left and right arrow keys to slide the bar. The more sensitive you make it (larger black bar) the harder it is to achieve stability in a changing environment.

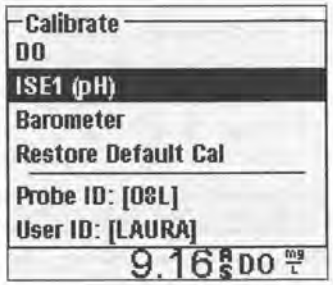
The **Auto Stable** system works by examining the previous 5 readings, computing the percent change in the data and comparing that change against a % threshold value. The % threshold value is determined by the **Sensitivity** bar setting. The following chart can be used as a guide when setting the Sensitivity bar.

Sensitivity selected by User	*% Data Variance Threshold*
100 - Most Sensitive, Sensitivity bar is set to the far right	0.025%
75	0.39375%
50	1.5%
25	1.13125%
0 - Least Sensitive, Sensitivity bar is set to the far left	0.15%

Within the Auto Stable menu, you can also choose to **Hold All Readings** for as many parameters as you set for Auto Stable. For instance, if ORP and pH have Auto Stable enabled and Hold All Readings is enabled, then the display will hold the readings once ORP and pH have both reached their Auto Stable settings. You must press the **Esc** key to "release" the held display in order to take subsequent readings. **Hold All Readings** must be reactivated after each use!

CALIBRATION - pH

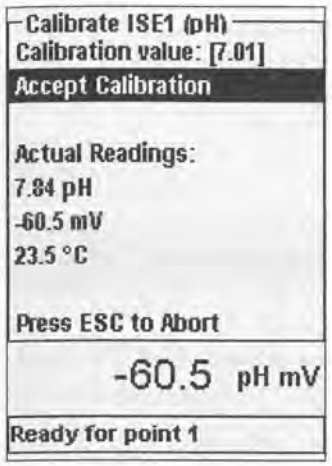
> *Calibration can be accomplished in any buffer order. pH 7 buffer should be used regardless of how many calibration points you use but it does not have to be used first.*

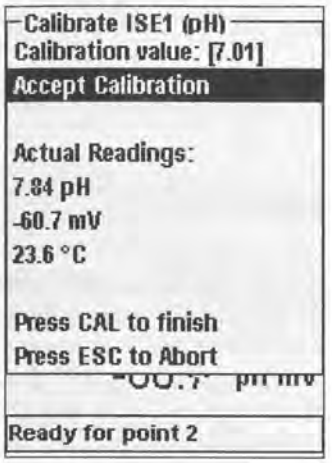


Press Cal . Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. User ID will appear automatically. Select 'None' if you do not want a User ID stored with the calibration. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting your User ID and/or Probe ID if appropriate, highlight **ISE (pH)** and press enter. The message line will show the instrument is "Ready for point 1". The pH calibration allows up to six calibration points.

Place the sensor in a traceable pH buffer solution. The instrument should automatically recognize the buffer value and display it at the top of the calibration screen. If the calibration value is incorrect, the auto buffer recognition setting





in the Sensor Setup menu may be incorrect. If necessary, highlight the **Calibration Value** and press enter to input the correct buffer value.

Once the pH and temperature readings stabilize, highlight **Accept Calibration** and press enter to accept the first calibration point. The message line will then display "Ready for point 2".

If you do not wish to perform a second point, press Cal to finalize the calibration. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled, you will be prompted to select these fields and then press Cal to finalize the calibration.

To continue with the 2nd point, place the sensor in the second buffer solution. The instrument should automatically recognize the second buffer value and display it at the top of the screen. If necessary, highlight the **Calibration Value** and press enter to input the correct buffer value. Once the pH and temperature readings stabilize, highlight **Accept Calibration** and press enter to confirm the second calibration point. The message line will then display 'Ready for point 3" and you can continue with the 3rd calibration point if desired.

If you do not wish to perform a 3rd calibration point, press Cal to complete the calibration. If User Field 1 or 2 are enabled, you will be prompted to select these fields and then press Cal to finalize the calibration.

Continue in this fashion until the desired number of calibration points is achieved (up to six).

> ⚠ *Once you've achieved the desired number of cal points you must press* Cal *to finalize the calibration and to allow the instrument to update the pH offset and slope. The instrument will not take these cal values into account until Cal has been pressed.*

The actual readings displayed during the calibration will NOT reflect the updated calibration information. These values will not change until Cal is pressed to finalize the calibration and to update the instrument.

ORP

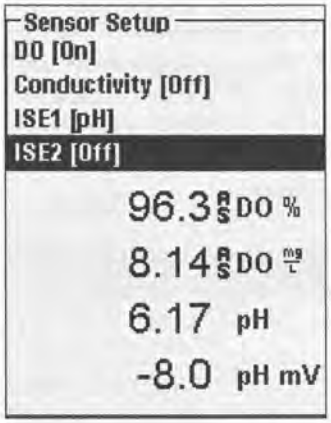
ORP sensors can be used on 60510-X, 6051020-X, 6051030-X, 6051010-X, and Quatro cables.

If using a 605103 pH/ORP combination sensor on a 6051020 or 6051030 cable you can report both pH and ORP by configuring ISE1 as pH and ISE2 as ORP in the Sensor Setup menu.

The 605103 pH/ORP combination sensor is not recommended for use on a 6051010 or Quatro cable. If used on one of these cable, only pH will be reported and ORP will not be measured.

SETUP - ORP

Press Sensor, highlight **Setup**, press enter.



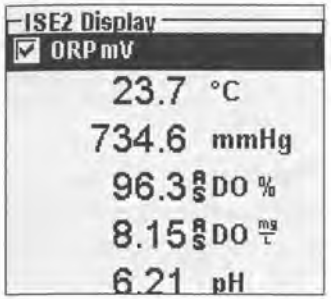
Highlight **ISE1** if using a 605102 (ORP sensor) on a 60510, 6051020, or 6051030 cable. Highlight **ISE2** is using a 605103 (pH/ORP sensor) on a 60510, 6051020, or 6051030 cable. If using a 6051010 or Quatro cable, highlight **ISE1** if the ORP sensor is installed in port 1 or highlight **ISE2** if the ORP sensor is installed in port 2 (a sensor must be installed in port 1 for port 2 to operate). Press enter.

Enabled allows you to enable or disable the ISE function and select which ISE sensor is installed on the cable. Highlight **Enabled** and press enter to enable (☑) or disable (☐) the ISE you selected previously (either ISE1 or ISE2).

After enabling the ISE function, ensure ORP is selected as the ISE sensor as shown in screen shot to the left. If necessary, highlight ORP and press enter to set the selected ISE to ORP.

If a sensor is Enabled that isn't connected to the instrument, the display will show an unstable false reading, ?????, or ----- next to the units.

DISPLAY - ORP

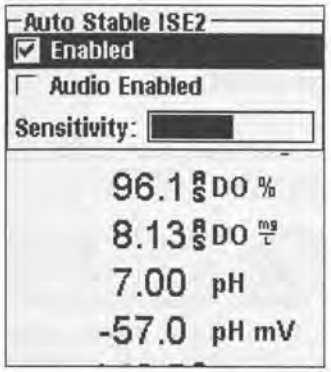


Press Sensor, highlight **Display** and press enter.

Highlight **ISE (ORP)** and press enter. You will not be able to **Display** the sensor unless it is **Enabled** in the Sensor Setup menu.

Press enter to enable (☑) or disable (☐) **ORP mV.**

AUTO STABLE - ORP



Press Sensor, highlight **Auto Stable** and press enter. Highlight **ISE (ORP)** and press enter.

Auto Stable indicates when a reading is stable. Highlight **Enabled** and/or **Audio Enabled** (instrument will beep when the stability is achieved) and press enter enable (☑) or disable (☐). When Auto Stable is enabled, **AS** will blink next to the parameter until it is stable. Once the parameter is stable, **AS** will stop blinking.

The Auto Stable **Sensitivity** can be decreased or increased. Highlight **Sensitivity** and use the left and right arrow keys to slide the bar. The more sensitive you make it (larger black bar) the harder it is to achieve stability in a changing environment.

The **Auto Stable** system works by examining the previous 5 readings, computing the percent change in the data and comparing that change against a % threshold value. The % threshold value is determined by the **Sensitivity** bar setting. The following chart can be used as a guide when setting the Sensitivity bar.

Sensitivity selected by User	*% Data Variance Threshold*
100 - Most Sensitive, Sensitivity bar is set to the far right	0.05%
75	0.62525%
50	1.275%
25	1.8875%
0 - Least Sensitive, Sensitivity bar is set to the far left	2.5%

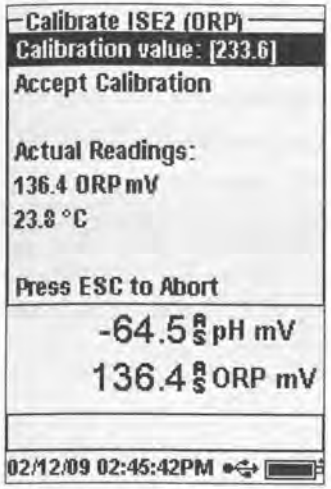
Within the Auto Stable menu, you can also choose to **Hold All Readings** for as many parameters as you set for Auto Stable. For instance, if ORP and pH have Auto Stable enabled and Hold All Readings is enabled, then the display will hold the readings once ORP and pH have both reached their Auto Stable settings. You must press the **Esc** key to "release" the held display in order to take subsequent readings. **Hold All Readings** must be reactivated after each use!

CALIBRATION - ORP

Press Cal . Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. User ID will appear automatically. Select 'None' if you do not want a User ID stored with the calibration. When enabled, these IDs are stored with each calibration record in the GLP file.

After selecting your User ID and/or Probe ID if appropriate, highlight **ISE (ORP)** and press enter. The message line will show the instrument is "Ready for point".

Place the sensor in a solution of known ORP and wait for the readings to stabilize.



Highlight **Calibration value** and press enter to input the value of the ORP calibration standard. If using the YSI Zobell calibration solution, the Pro Plus will automatically determine the calibration value. However, the calibration value should be verified against the chart on the side of the Zobell bottle. Next, once the temperature and ORP readings stabilize, highlight **Accept Calibration** and press enter to calibrate. Or, press Esc to cancel the calibration. If User Field 1 or 2 are enabled, you will be prompted to select the fields and then press Cal to complete the calibration.

AMMONIUM, NITRATE, CHLORIDE

Ammonium, Nitrate, and Chloride sensors can be used on 60510-X, 6051020-X, 6051030-X, 6051010-X, and Quatro cables. These cables also accommodate pH and ORP sensors so instrument setup is important.

> **WARNING**: *Ammonium, Nitrate, and Chloride sensors should only be used at DEPTHS OF LESS THAN 55 FEET (17 METERS). Use of the sensors at greater depths is likely to permanently damage the sensor membrane.*

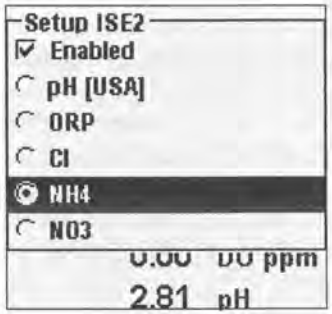
> **WARNING**: *Ammonium, Nitrate, and Chloride sensors should only be used in FRESHWATER.*

SETUP - AMMONIUM, NITRATE, CHLORIDE

Install the Ammonium, Nitrate, or Chloride sensor in Port 2 if using in conjunction with pH or ORP sensor on a 6051010 or Quatro cable. See the **Getting Started Setup** section of this manual for a complete list of cable/sensor configurations.

Press Sensor , highlight **Setup**, press enter. Highlight **ISE1** if using an ammonium, nitrate, or chloride sensor on a 60510, 6051020, or 6051030 cable.

If using a 6051010 or Quatro cable highlight **ISE1** if the sensor is installed in Port 1 or highlight **ISE2** if the sensor is installed in Port 2. Press enter.



Enabled allows you to enable or disable the ISE function and select which ISE sensor is installed on the cable.

Highlight **Enabled** and press enter to enable (☑) or disable (☐) the ISE you selected previously (either ISE1 or ISE2).

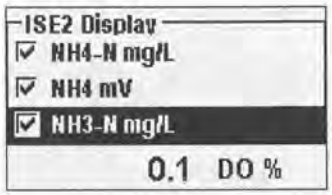
After enabling the ISE function, choose the parameter you want enabled for that ISE. In this example, NH4 is selected.

Cl - Chloride
NH4 - Ammonium
NO3 - Nitrate

> ⓘ *If a sensor is Enabled that isn't connected to the instrument, the display will show an unstable, false reading next to the units.*

DISPLAY - AMMONIUM, NITRATE, CHLORIDE

Press Sensor ❗, highlight **Display**, press enter. Highlight **ISE2(NH4)**, press enter. You will not be able to **Display** the sensor unless it is **Enabled**.



Highlight the value you wish to display and press enter to enable (☑) . Ammonium can be displayed as **NH4-N mg/L** (Ammonium), **NH3-N** (Ammonia) and/or **NH4 mV** (sensor signal).

The same steps would be followed to display nitrate or chloride.

Ammonia is calculated from the pH, salinity, and temperature readings. If a pH sensor is not in use, the instrument will assume the sample is neutral (pH 7) for the calculation. If a conductivity sensor (Salinity) is not in use, the instrument will use the salinity correction value entered in the Sensor Menu for the calculation (see Salinity Correction within the Dissolved Oxygen Setup section of this manual for more information).

AUTO STABLE - AMMONIUM, NITRATE, CHLORIDE

Auto Stable indicates when a reading is stable. When Auto Stable is enabled, **AS** will blink next to the parameter until it is stable. Once the parameter is stable, **AS** will stop blinking.

To enable Auto Stable, press Sensor ❗, highlight **Auto Stable** and press enter. Highlight **ISE1** or **ISE2** and press enter.

Highlight **Enabled** and/or **Audio Enabled** (instrument will beep when the stability is achieved) and press enter to confirm. The Auto Stable **Sensitivity** can be decreased or increased. Highlight **Sensitivity** and use the left and right arrow keys to slide the bar. The more sensitive you make it (larger black bar) the harder it is to achieve stability in a changing environment.

The **Auto Stable** system works by examining the previous 5 readings, computing the percent change in the data and comparing that change against a % threshold value. The % threshold value is determined by the **Sensitivity** bar setting. The following chart can be used as a guide when setting the Sensitivity bar.

Sensitivity selected by User	*% Data Variance Threshold*
100 - Most Sensitive, Sensitivity bar is set to the far right	0.05%
75	0.62525%
50	1.275%
25	1.8875%
0 - Least Sensitive, Sensitivity bar is set to the far left	2.5%

Within the Auto Stable menu, you can also choose to **Hold All Readings** for as many parameters as you set for Auto Stable. For instance, if pH and Ammonium have Auto Stable enabled and Hold All Readings is also enabled, then the display will hold the readings once pH and Ammonium have both reached their Auto Stable settings. You must press the Esc key to "release" the held display in order to take subsequent readings. **Hold All Readings** must be reactivated after each use!

CALIBRATION - AMMONIUM, NITRATE, CHLORIDE

The 6051030 ISE/conductivity cable has a specialized calibration container that resembles a large test tube. This calibration chamber can be used to calibrate the ISE sensors with the conductivity sensor. A ring-stand should be used to support this chamber.

> *The ISE sensors can be calibrated at 1, 2, or 3-points.*
> **A 2-point calibration without chilling a third calibration solution is extremely accurate and is the preferred method.**
> *Greatest accuracy is achieved if the actual samples to be measured are within 10 °C of the calibration solutions.*

CALIBRATION TIP: Exposure to the high ionic content of pH buffers can cause a significant, but temporary, drift in the ammonium, nitrate, and chloride ISE sensors. Therefore, when calibrating the pH sensor, YSI recommends that you use one of the following methods to minimize errors in the subsequent readings:

- When calibrating pH, remove ISE sensors from the cable bulkhead and plug the ports. After pH calibration is complete, replace the ISE sensors and proceed with their calibration with no stabilization delay.

- Calibrate pH first, immersing all of the sensors in the pH buffers. After calibrating pH, place the sensors in 100 mg/L nitrate or ammonium standard or 1000 mg/L chloride standard depending on the sensor in use and monitor the reading. Usually, the reading starts low and may take awhile to reach a stable value. When it does, proceed with the calibration. This may take several hours.

Preparing Chloride Standards

The following recipes are provided for preparation of 10 and 1000 mg/L chloride reagents. Nitrate and Ammonium standards can be purchased from YSI or other laboratory supply companies.

It is important to note that some of the chemicals required for these solutions could be hazardous under some conditions. It is the responsibility of the user to obtain and study the MSDS for each chemical and to follow the required instructions with regard to handling and disposal of these chemicals.

You will need: Solid sodium chloride or a certified 1000 mg/L chloride solution from a supplier, magnesium sulfate, high purity water, a good quality analytical

balance, 1000 mL volumetric flask, an accurate 10 mL measuring devices, and 1000 mL glass or plastic storage vessels.

1000 mg/L Standard: Accurately weigh 1.655 grams of anhydrous sodium chloride and transfer into a 1000 mL volumetric flask. Add 0.5 grams of anhydrous magnesium sulfate to the flask. Add 500 mL of water to the flask, swirl to dissolve all of the reagents , and then dilute to the volumetric mark with water. Mix well by repeated inversion and then transfer the 1000 mg/L standard to a storage bottle. Rinse the flask extensively with water prior to its use in the preparation of the 10 mg/L standard. Alternatively, simply add 0.5 grams of magnesium sulfate to a liter of a 1000 mg/L chloride standard from a certified supplier.

10 mg/L Standard: Accurately measure 10 mL of the above 1000 mg/L standard solution into a 1000 mL volumetric flask. Add 0.5 grams of anhydrous magnesium sulfate to the flask. Add 500 mL of water, swirl to dissolve the solid reagents, and then dilute to the volumetric mark with water. Mix well by repeated inversion and then transfer the 10 mg/L standard to a storage bottle.

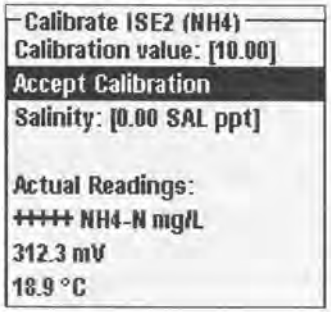
AMMONIUM (NH4+) , NITRATE (NO3-), AND CHLORIDE CL- 2-POINT

The calibration procedures for ammonium, nitrate, or chloride are similar to pH. The only differences are the calibration solutions. Recommended values for calibration solutions and the order of calibration are as follows:

Sensor	*1st Point*	*2nd Point*
Ammonium-nitrogen (NH4-N)	1 mg/L	100 mg/L
Nitrate-nitrogen (NO3-N)	1 mg/L	100 mg/L
Chloride (Cl-)	10 mg/L	1000 mg/L

Place the proper amount of 1 mg/L standard for Ammonium or Nitrate (10 mg/l for Chloride) into a clean, dry or pre-rinsed calibration cup. Carefully immerse the sensor into the solution. Allow at least 1 minute for temperature equilibration before proceeding.

Press Cal (Cal). Highlight Probe ID or User ID if you wish to add, select, edit, or delete an ID. Probe ID must be enabled in the System GLP menu to appear in the Calibrate menu. User ID will appear automatically. Select 'None' if you do not want a User ID stored with the calibration. When enabled, these IDs are stored with each calibration record in the GLP file.



After selecting your User ID and/or Probe ID if appropriate, highlight **Ammonium**, **Nitrate**, or **Chloride** to access the appropriate calibration, and press enter. The parameter you want to calibrate may appear under ISE1 or ISE2 depending on your cable type and setup. The message line will show the instrument is ready for the 1st calibration point.

The instrument will display the calibration value at the top of the screen. If necessary, highlight the **Calibration value** and press enter to input the correct value.

Once the readings stabilize, highlight **Accept Calibration** and press enter to accept the first calibration point. The message line will then display "Ready for point 2".

If you do not wish to perform a second point, press Cal (Cal) to finalize the calibration. If User Field 1 or 2 are enabled, you will be prompted to select these fields and then press Cal (Cal) to finalize the calibration. Alternatively, you may press Esc (Esc) to cancel the calibration.

To continue with the 2nd point, rinse the sensor with clean water, then dry it before placing it in the second calibration standard. Allow at least 1 minute for temperature equilibration before proceeding. The instrument will display the second calibration value at the top of the screen. If necessary, highlight the **Calibration value** and press enter to input the correct buffer value. Once the readings stabilize, highlight **Accept Calibration** and press enter to confirm the second calibration point. The message line will then display "Ready for point 3" and you can continue with the 3rd calibration point if desired.

If you do not wish to perform a 3rd calibration point, press Cal (Cal) to complete the calibration. If User Field 1 or 2 are enabled, you will be prompted to select these fields and then press Cal (Cal) to finalize the calibration. Alternatively, you may press Esc (Esc) to cancel the calibration.

AMMONIUM (NH4+) , NITRATE (NO3-), AND CHLORIDE CL- 3-POINT

A 2-point calibration without chilling a third calibration solution is extremely accurate and is the preferred method. If you must perform a 3-point calibration, the following procedure requires one portion of the high concentration calibration solution and two portions of the low concentration calibration solution. The

high concentration solution and one of the low concentration solutions should be at ambient temperature. The other low concentration solution should be chilled to less than 10 °C prior to calibration.

> ⚠ **WARNING:** *The chilled calibration solution MUST BE CHILLED TO AT LEAST 5 °C COOLER THAN THE 1ST CALIBRATION POINT, otherwise the 1st point will be OVERRIDDEN.*

Follow the procedure for a 2-point cal. After the second calibration point is complete, the message line with state 'Ready for point 3". Place the proper amount of chilled 1 mg/L standard (10 mg/L for the chloride) into a clean, dry or pre-rinsed calibration cup. Carefully immerse the sensor into the solution. Allow for temperature equilibration. If necessary, highlight **Calibration value** and press enter to manually enter the 3rd buffer value. Once the readings are stable, highlight **Accept Calibration** and press enter to confirm. Press Cal (Cal) to complete the calibration. If User Field 1 or 2 are enabled, you will be prompted to select these fields and then press Cal (Cal) to finalize the calibration. Alternatively, press Esc (Esc) to cancel the calibration.

TAKING MEASUREMENTS

To obtain the most accurate readings, be sure the instrument is calibrated before taking measurements.

DISSOLVED OXYGEN

Turn the instrument on and wait 5-15 minutes if using a polarographic sensor. If using a field cable/sensor, install the sensor guard to protect the sensor and membrane. Place the probe in the sample to be measured and give the probe a quick shake to release any air bubbles. Allow the temperature readings to stabilize. Next, stir the probe in the sample to overcome the stirring dependence of the dissolved oxygen sensor. You must provide at least 3 inches per second for 2.0 PE membranes, 6 inches per second for 1.25 PE membranes, and 12 inches per second for Teflon* membranes. Once the values plateau and stabilize, you may record the measurement and/or log the data set. The dissolved oxygen reading will drop over time if stirring is ceased.

If placing the DO sensor into a stream or fast flowing waters it is best to place it perpendicular to the flow and NOT facing into the flow.

If using the DO sensor in an aeration tank/basin, it is helpful to make sure bubbles do not burst on the membrane since this may cause unstable readings. You should be able to prevent this by pointing the sensor upwards so it's facing

the sky and then twist tying, zip tying, or rubber banding the bulkhead to the cable. Making a simple curve to the cable without bending or breaking the cable will allow you to lower the sensor into the aeration tank while the sensor points skyward so the bubbles are no longer bursting on the membrane surface.

CONDUCTIVITY

The conductivity sensor will provide quick readings as long as the entire sensor is submerged and no air bubbles are trapped in the sensor area. Immerse the probe into the sample so the sensors are completely submerged and then shake the probe to release any air bubbles. Occasional cleaning of the sensor may be necessary to maintain accuracy and increase the responsiveness. To clean the sensor, use the conductivity cleaning brush with a mild detergent.

pH/ORP

pH and ORP readings are typically quick and accurate. However, it may take the sensors a little longer to stabilize if they become coated or fouled. To improve the response time of a sensor, follow the cleaning steps in the Maintenance section of this manual.

AMMONIUM, NITRATE, AND CHLORIDE

These sensors may take a little longer to stabilize if the tips are dirty or fouled. If installed with a pH sensor, always maintain a clean pH sensor for a more rapid sensor stabilization.

These sensors can only be used in freshwater.

LOGGING DATA

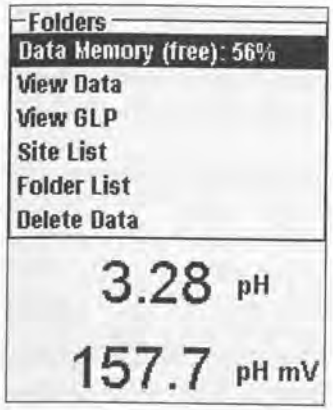
Log One Sample is already highlighted in Run mode. Press enter to open a submenu. If **Use Site List** and or **Use Folder List** are enabled in the Logging Setup menu, you will have to option to select these two items before the data point is logged. If necessary, use the keypad to create a new Site or Folder name. If Site List and Folder List are disabled in the **System** menu, you will not see these options when logging a sample. Once the Site and/or Folder name is selected, highlight **Log Now** and press Enter. The instrument will confirm that the data point was successfully logged.

If you would like to log at a specific interval vs. logging one sample at a time or vice versa, press **System**, then highlight **Logging** and press enter. Select **Continuous Mode** and adjust the time Interval if necessary. On the Run screen, the option to log will change from **Log One Sample** to **Start Logging** based on the time interval entered in the Logging Menu.

During a continuous log, the Start Logging dialog box on the Run screen will change to Stop Logging. Press Enter to stop continuous logging.

FILES AND SITE LISTS

FILE MEMORY

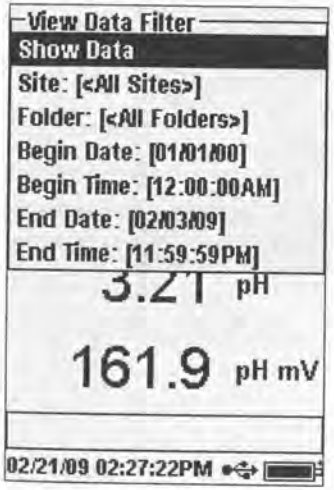


To view the file memory, press **File**.

The **Data Memory** shows a percentage indicating the amount of memory available. If the file memory is near 0%, files should be downloaded to a PC and/or deleted to free up memory.

VIEWING SAVED DATA

Press **File**, highlight **View Data** and press enter.

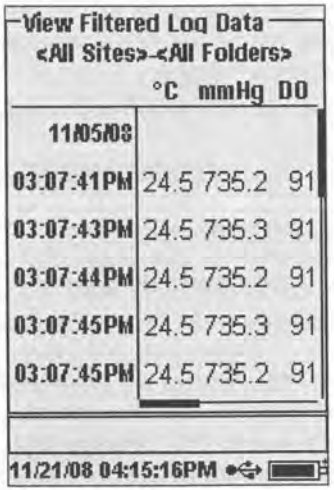


Configuring your data view:

Site: will allow you to view data from one particular site or all sites. Highlight **Site**, press enter, and select the site you wish to view data from or select **All Sites** to view data from all sites.

Folder: will allow you to view data from one particular folder or all folders. Highlight **Folder**, press enter, and select the file you wish to view data from or select **All Folders** to view data from all folders.

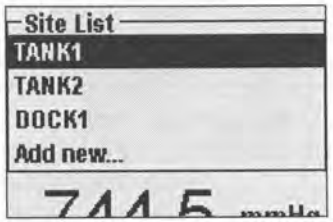
Begin Date, Begin Time, End Date, and **End Time:** will allow you to view data collected between a specific time period. Highlight the



time qualifier you would like to set, press enter, and use the numeric entry screen to select the date/time you wish to view.

After making your selections in the Data Filter, highlight **Show Data** and press enter. The data will have date and time stamps. You will likely have to scroll up and down and side to side using the arrow keys to completely view the data file. No more than 100 data records can be viewed at one time.

SITE LIST



To modify the **Site List**, press **File**, highlight **Site List**, and press enter. Enter new site names or edit existing sites with the alpha/numeric entry screen. Site lists can also be created and edited on your PC with Data Manager and then downloaded to the instrument.

FOLDER

To modify the **Folder List**, press **File**, highlight **Folder List**, and press enter. Enter new Folder names or edit existing folders with the alpha/numeric entry screen.

DELETE DATA

Press **File**, highlight **Delete Data**, and press enter. Enter the criteria for the data you wish to delete in the Delete Data Filter, then highlight **Delete Data** and press enter.

DATA MANAGER DESKTOP SOFTWARE

Data Manager is provided with the purchase of a Pro Plus Instrument. Data Manager is a powerful Windows® based software that will allow you to easily manage logged data, set up instruments, and conduct real time studies.

Minimum PC system requirements for Data Manager are Windows® 2000 with SP4 (minimum) or Windows® XP with SP2 (minimum) Operating System, 300 MHz or higher Pentium®-compatible CPU, 128 MB of RAM or higher, 80 MB or more of free hard-disk space, USB 2.0, and Microsoft® .NET.

Data Manager needs to be installed on a PC before use and before you try to connect a Pro Plus to your PC. First install Data Manger, then connect the communications saddle to the PC and, lastly, connect the saddle to your Pro Plus. Data Manager will identify the connected instruments by their Unit ID.Refer to the Data Manager Readme file for detailed installation instructions. Data Manager will then recognize the attached instruments.

From the 'home' screen of Data Manager, see below, you can select one of the following functions: Retrieve Instrument Data, Real Time Instrument Data, Instrument Configuration, or View Saved File/Data.

USING THE COMMUNICATIONS SADDLE

> ⚠ **WARNING:** *DO NOT connect the Communications Saddle to your PC before installing Data Manager. The Communication Saddle drivers MUST be installed prior to connecting it to your PC. The drivers will install automatically during the Data Manager installation. The first time the saddle is connected to the PC, you may have to walk through a couple of installation wizards. For detailed instruction, please refer to the Readme file located on the CD that was included with your instrument.*

A PC will recognize the Communications Saddle (saddle) as a YSI water quality instrument with or without the Pro Plus installed in the saddle.

To connect the saddle to a Pro Plus, simply align the saddle to the oval section on top of the instrument and push it down to snap it in place (Figure 6).

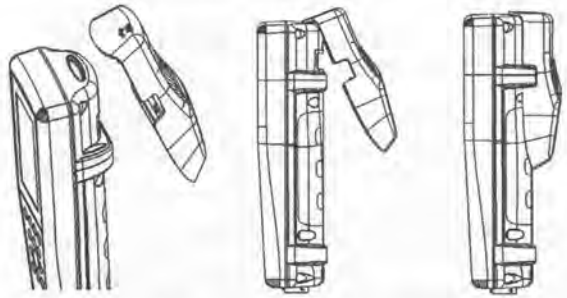


Figure 6. Locate the oval alignment groove at the top of the instrument and inside the saddle. Insert the saddle into this oval groove. Press the saddle towards the back of the instrument until it snaps into place.

Connect the USB cable to the top of the saddle and to a USB port on the PC. Once Data Manager is launched, the program will recognize all saddles with instruments connected to the PC.

The instrument will be powered through the saddle and USB connection when connected to the PC. However, the instrument must still have batteries installed in order to keep the date and time correct when powering the PC off at night. Make sure the instrument is turned off first, then turn off the PC to keep the instrument from running all night on the batteries. If you power it off and power off the PC the instrument will keep the correct date and time if it has batteries installed. If batteries are not installed, the instrument's date and time will not remain correct and will need to be reset each morning.

MANAGE LOGGED DATA

Data that has been logged to the Professional Plus can easily be uploaded to the PC via the provided USB saddle. You can upload sensor data, GLP files, site lists, and instrument configuration files individually or all at once. After connecting the instrument to the PC via the USB saddle and cable and launching Data Manager, click the **Retrieve Instrument Data** tab. Click on the Instrument's Unit ID you would like to retrieve data from, then select the files you would like to retrieve and click Start.

Once the sensor data is uploaded to the PC, you can graph and view tabular data by instrument Unit ID, date/time, site name, and/or folder name. This allows you to configure the report according to your needs. You can choose to view all data from all instruments, or select a certain date/time range for only a few specific instruments, there are multiple ways to view the data. Once the report has been defined, you will be able to print the graph and/or export the table.

Data Manager takes information management one step further and allows you to delete specific points instead of entire files. This allows you to clean up data that is no longer needed or that may have been collected erroneously, for example, when the sensor was out of the water. If you can not delete data due to regulation and compliance purposes, Data Manager has the solution. While viewing logged data or real time data, you have the ability to 'tag' individual data points with comments.

In addition to sensor data, you will be able to view GLP files, site lists, and configuration files that have been uploaded from the instrument. These can be printed and exported as well.

REAL TIME STUDIES

Data Manager allows you to view real time data on the PC.

After selecting your instrument, click the **Real Time Instrument Data** tab. Next, input your sample interval, site/folder name, select the parameters you wish to view and click **OK**. You must click **Start** on the next screen to begin your real time study. Choose to hide the table or graph by unchecking the box next to these options. Click **Stop**, then **Edit Setup** to change the Y-scale min/max of the graph, to select different colors, or to name your graph. Add a comment to a data point by clicking in the comment field of the table next to the data point. You may also **Print** the graph and **Export** the data for viewing in another program.

CONFIGURE INSTRUMENTS

Data Manager allows for easy and quick configuration of single or multiple instruments. Once you have uploaded a site list or configuration file, you can edit it as needed, save it, and download it to other instruments. You no longer need to configure each instrument individually. By using the same configuration file for all instruments, you can rest assured that all instruments will have identical settings.

New site lists and configuration files can be created in Data Manager as well. These lists and files can be downloaded to one or multiple instruments. Save time by creating these files on your PC and downloading them to the instrument as opposed to creating them on the instrument.

CARE, MAINTENANCE, AND STORAGE

This section describes the proper procedures for care, maintenance and storage of the sensors. The goal is to maximize their lifetime and minimize down-time associated with improper sensor usage.

UPDATING INSTRUMENT FIRMWARE

The instrument's firmware can be updated via www.ysi.com. There you will find the new firmware file and instructions on how to update the instrument. There is no need to send the instrument back to the factory for upgrades.

GENERAL MAINTENANCE

GENERAL MAINTENANCE - O-RINGS

The instrument utilizes o-rings as seals to prevent water from entering the battery compartment and sensor ports. Following the recommended procedures will help keep your instrument functioning properly.

If the o-rings and sealing surfaces are not maintained properly, it is possible that water can enter the battery compartment and/or sensor ports of the instrument. If water enters these areas, it can severely damage the battery terminals or sensor ports causing loss of battery power, false readings, and corrosion to the sensors or battery terminals. Therefore, when the battery compartment lid is removed, the o-ring that provides the seal should be carefully inspected for contamination (e.g. debris, grit, etc.) and cleaned if necessary.

The same inspection should be made of the o-rings associated with the sensor connectors when they are removed. If no dirt or damage to the o-rings is evident, then they should be lightly greased without removal from their groove. However, if there is any indication of damage, the o-ring should be replaced with an identical o-ring. At the time of o-ring replacement, the entire o-ring assembly should be cleaned.

To remove the o-rings:
Use a small, flat-bladed screwdriver or similar blunt-tipped tool to remove the o-ring from its groove. Check the o-ring and the groove for any excess grease or contamination. If contamination is evident, clean the o-ring and nearby plastic parts with lens cleaning tissue or equivalent lint-free cloth. Alcohol can be used to clean the plastic parts, but use only water and mild detergent on the o-ring itself. Also, inspect the o-rings for nicks and imperfections.

> ⚠ *Using alcohol on o-rings may cause a loss of elasticity and may promote cracking. Do not use a sharp object to remove the o-rings. Damage to the o-ring or the groove may result.*

Before re-installing the o-rings, make sure to use a clean workspace, clean hands, and avoid contact with anything that may leave fibers on the o-ring or grooves. Even a very small amount of contamination (hair, grit, etc.) may cause a leak.

To re-install the o-rings:
Place a small amount of o-ring grease between your thumb and index finger. (More grease is NOT BETTER!)

Draw the o-ring through the grease while pressing the fingers together to place a very light covering of grease to the o-ring. Place the o-ring into its groove making sure that it does not twist or roll.

Use your grease-coated finger to once again lightly go over the mating surface of the o-ring.

> ⚠ *Do not over-grease the o-rings. The excess grease may collect grit particles that can compromise the seal. Excess grease can also cause the waterproofing capabilities of the o-ring to diminish, potentially causing leaks. If excess grease is present, remove it using a lens cloth or lint-free cloth.*

GENERAL MAINTENANCE - SENSOR PORTS

It is important that the entire sensor connector end be dry when installing, removing or replacing. This will prevent water from entering the port. Once a sensor is removed, examine the connector inside the port. If any moisture is present, use compressed air to completely dry the connector or place directly in front of a steady flow of fresh air. If the connector is corroded, return the cable to your dealer or directly to an YSI Repair Center.

> ⓘ *Remove sensors upside down (facing the ground) to help prevent water from entering the port upon removal.*

SENSOR MAINTENANCE

SENSOR MAINTENANCE - DISSOLVED OXYGEN

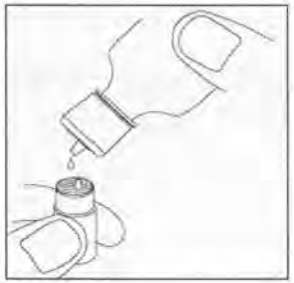
Membrane Cap Installation

The DO sensor (Polarographic and Galvanic) is shipped with a dry, protective red cap that will need to be removed before using. Remove the protective cap or used membrane cap and replace it with a new membrane cap following these instructions:

Remove the sensor guard to access the sensor tip.

Unscrew and remove any old membrane cap by holding the sensor when unscrewing the membrane cap and discard.

Thoroughly rinse the sensor tip with distilled or DI water.



Fill a new membrane cap with O2 sensor electrolyte solution that has been prepared according to the directions on the bottle. Be very careful not to touch the membrane surface. Lightly tap the side of the membrane cap to release bubbles that may be trapped.

Thread the membrane cap onto the sensor. It is normal for a small amount of electrolyte to overflow.

Polarographic Sensors - Model # 605203

The KCl (potassium chloride) solution and the membrane cap should be changed at least once every 30 days during regular use. In addition, the KCl solution and membrane should be changed if (a) bubbles are visible under the membrane; (b) significant deposits of dried electrolyte are visible on the membrane; and (c) if the sensor shows unstable readings or other sensor-related symptoms.

During membrane changes, examine the gold cathode at the tip of the sensor and the silver anode along the shaft of the sensor. If either the silver anode is black in color or the gold cathode is dull, the sensor may need resurfaced using the fine sanding disks included in the membrane kit. Do not sand the electrode every membrane change as this is not routine maintenance. In fact, visually, the anode may appear tarnished and operate just fine. YSI recommends using the 400 grit wet/dry sanding disks to resurface the electrodes if the sensor has difficulty stabilizing or calibrating after a membrane change.

To resurface the sensor using the fine sanding disk, follow the instructions below.

Gold Cathode:

For correct sensor operation, the gold cathode must be textured properly. It can become tarnished or plated with silver after extended use. Never use chemicals or abrasives not recommended or supplied by YSI.

First dry the sensor tip completely with lens cleaning tissue. Wet a sanding disk with a small amount of clean water and place it face up in the palm of your hand. Next, with your free hand, hold the sensor in a vertical position, tip down. Place the sensor tip directly down on the sanding disk and twist it in a circular motion to sand the gold cathode. The goal is to sand off any build-up and to lightly scratch the cathode to provide a larger surface area for the O2 solution under the membrane. Usually, 3 to 4 twists of the sanding disk are sufficient to remove deposits and for the gold to appear to have a matte finish. Rinse thoroughly and wipe the gold cathode with a wet paper towel before putting on a new membrane

cap. If the cathode remains tarnished, contact YSI Technical Support or the Authorized dealer where you purchased the instrument.

Silver Anode

After extended use, a thick layer of Silver Chloride (AgCl) builds up on the silver anode reducing the sensitivity of the sensor. The anode must be cleaned to remove this layer and restore proper performance. The cleaning can be chemical or mechanical:

Chemical cleaning: Remove the membrane cap and rinse the electrodes with deionized or distilled water. Soak the sensing anode section of the sensor in a 14% ammonium hydroxide solution for 2 to 3 minutes or in a 3% ammonia solution overnight for 8-12 hours (most household ammonia cleaners are typically around 3%). Rinse heavily in cool tap water followed by a thorough rinsing with distilled or deionized water. The anode should then be thoroughly wiped with a wet paper towel to remove the residual layer from the anode. You can smell the tip of the sensor to help ensure all the ammonia has been rinsed off. Trapping residual ammonia under the new membrane cap can quickly tarnish the electrode and/or give false readings.

> ⓘ *Chemical cleaning should be performed as infrequently as possible. First attempt a membrane change and recalibrate. If a new membrane does not resolve the problem, then proceed with cleaning.*

Mechanical cleaning: In order to sand the silver anode along the shaft of the sensor, simply hold the sensor in a vertical position. Wet the sanding disk with a small amount of clean water then gently wrap it around the sensor shaft and twist it a few times to lightly sand the anode (the goal is to simply sand off any build-up without scratching or removing layers of the anode itself). Usually, 3 to 4 twists of the sanding disk are sufficient to remove deposits. However, in extreme cases, more sanding may be required to regenerate the original silver surface.

After completing the sanding procedure, repeatedly rinse the electrode with clean water and wipe with lens cleaning tissue to remove any grit left by the sanding disk. Thoroughly rinse the entire tip of the sensor with distilled or deionized water and install a new membrane.

> ⚠ **IMPORTANT**: *Be sure to: (1) Use only the fine sanding disks provided and (2) Sand as mentioned in the above procedures. Not adhering to either of these instructions can damage the electrodes. If this procedure is unsuccessful, as indicated by improper electrode performance, contact YSI Technical Support or the Authorized dealer where you purchased the instrument.*

We recommend that the Sodium Chloride (NaCl) solution and the membrane cap be changed at least once every 60 days during regular use. In addition, the NaCl solution and membrane should be changed if (a) bubbles are visible under the membrane; (b) significant deposits of dried electrolyte are visible around the membrane; and (c) if the sensor shows unstable readings or other sensor-related symptoms.

The Galvanic dissolved oxygen sensor is continuously reducing oxygen even when the display of the instrument is not active. This factor allows the sensor to be used with no warm-up period as soon as the instrument is powered on (instant on DO). However, because the sensor is "on" all the time, some solid from the oxidation of the zinc anode will form in the electrolyte within 1-2 weeks of activation. Small amounts of the solid will generally cause no performance problems, but excessive amounts may result in jumpy dissolved oxygen readings. The rate of solid formation is dependent on the type of membrane installed. The formation of solids based on membrane type typically form more rapidly with the 5912 (1 mil Teflon), less rapid with 5913 (1.25 mil PE), and least rapid with 5914 (2 mil PE).

> ⓘ *The Galvanic DO sensor solution will appear milky white after use but will NOT affect the accuracy of the sensor unless there is excessive build up. The color change is acceptable and normal as long as DO readings remain stable.*

At the time the membrane cap is changed, YSI recommends that you rinse the anode (silver shaft of the sensor) with purified water and wipe with a clean paper towel. If white deposits are evident on the anode after cleaning, YSI recommends that you remove this material by sanding the anode with the sandpaper disk enclosed in your membrane kit. Follow the "Mechanical Cleaning" instructions under the Polarographic Silver Anode section.

> ⚠ **IMPORTANT**: *Be sure to: (1) Use only the fine sanding disks provided and (2) Sand as mentioned in the above procedures. Not adhering to either of these instructions can damage the electrodes.*
> **WARNING**: *DO NOT PERFORM THE POLAROGRAPHIC CHEMICAL CLEANING ON A GALVANIC SENSOR. If this procedure is unsuccessful, as indicated by improper electrode performance, contact YSI Technical Support or the Authorized dealer where you purchased the instrument.*

SENSOR MAINTENANCE - CONDUCTIVITY

The openings that allow sample access to the conductivity electrodes should be cleaned regularly. The small cleaning brush included in the Maintenance Kit is ideal for this purpose. Dip the brush in clean water and insert it into each hole 10 to 12 times. In the event that deposits have formed on the electrodes, it may be necessary to use a mild detergent (laboratory grade soap or bathroom foaming tile cleaner) with the brush. Rinse thoroughly with clean water, then check the response and accuracy of the conductivity cell with a calibration standard.

> ⓘ *If this procedure is unsuccessful, as indicated by improper electrode performance, contact YSI Technical Support or the Authorized dealer where you purchased the instrument.*

SENSOR MAINTENANCE - TEMPERATURE

You must keep the temperature portion of the sensor free of build up. Other than that, the sensor requires no maintenance. The conductivity cleaning brush can be used to scrub the temperature sensor if needed. Alternatively, you can use a toothbrush to clean the sensor.

SENSOR MAINTENANCE - pH, ORP AND COMBINATION pH/ORP

> ⓘ *Typical working life for pH and ORP sensors is approximately 12-24 months depending on usage, storage, and maintenance. Proper storage and maintenance generally extends the sensor's working life.*

Cleaning is required whenever deposits or contaminants appear on the glass and/or platinum surfaces or when the sensor's response slows. The cleaning can be chemical and/or mechanical.

Removing the sensor from the cable may make cleaning easier. Initially, use clean water and a soft clean cloth, lens cleaning tissue, or cotton swab to remove all foreign material from the glass bulb and/or platinum button. Then use a moistened cotton swab to carefully remove any material that may be blocking the reference electrode junction of the sensor.

> ⚠ **CAUTION:** *When using a cotton swab, be careful NOT to wedge the swab between the guard and the glass sensor. If necessary, remove cotton from the swab tip, so that the cotton can reach all parts of the sensor tip without stress. You can also use a pipe cleaner for this operation if more convenient.*

If good pH and/or ORP response is not restored, perform the following additional procedure:

1. Soak the sensor for 10-15 minutes in clean water containing a few drops of commercial dishwashing liquid.
2. GENTLY clean the glass bulb and platinum button by rubbing with a cotton swab soaked in the cleaning solution.
3. Rinse the sensor in clean water, wipe with a cotton swab saturated with clean water, and then rerinse with clean water.

If good pH and/or ORP response is still not restored, perform the following additional procedure:

1. Soak the sensor for 30-60 minutes in one molar (1 M) hydrochloric acid (HCl). This reagent can be purchased from most lab supply distributors. Be sure to follow the safety instructions included with the acid.
2. Rinse the sensor in clean water, wipe with a cotton swab saturated with clean water (not DI water), and then rerinse with clean water. To be certain that all traces of the acid are removed from the sensor crevices, soak the sensor in clean water for about an hour with occasional stirring.

If biological contamination of the reference junction is suspected or if good response is not restored by the above procedures, perform the following additional cleaning step:

1. Soak the sensor for approximately 1 hour in a 1:1 dilution of commercially-available chlorine bleach.
2. Rinse the sensor with clean water and then soak for at least 1 hour in clean water with occasional stirring to remove residual bleach from the junction. (If possible, soak the sensor for a period of time longer than 1 hour in order to be certain that all traces of chlorine bleach are removed.) Then rerinse the sensor with clean water and retest.

> ⓘ *Dry the port and sensor connector with compressed air and apply a very thin coat of o-ring lubricant to all o-rings before reinstallation.*

SENSOR MAINTENANCE - CHLORIDE

> ⓘ *Typical working life for chloride sensors is approximately 3-6 months depending on usage, storage, and maintenance. Proper storage and maintenance generally extends the sensor's working life.*

The chloride sensor is considered a pellet membrane ISE. As always, when handling sensors, care should be taken to avoid damaging the membrane. This

sensor can be regenerated by washing with alcohol and/or gently polishing with fine emery paper in a circular motion to remove any deposits or discoloration, then thoroughly washing with deionized water to remove any debris. The sensor may require soaking in the high standard chloride calibration solution to recover its performance.

SENSOR MAINTENANCE - AMMONIUM AND NITRATE

> *Typical working life for ammonium and nitrate sensors is approximately 3-6 months depending on usage, storage and maintenance. Proper storage and maintenance generally extends the sensor's working life.*

The ammonium and nitrate sensors are PVC membranes. As always, when handling a sensor, care should be taken to avoid damaging the membrane. After extensive use the membranes may become coated with a deposit or scoured with fine scratches which may cause a slow or reduced response (low slope) or unstable readings. Deposits may be removed with a fine jet of deionized water or rinsing in alcohol followed by soaking in the high standard calibration solution. Gently dab dry with a lint-free tissue before taking measurements.

SENSOR STORAGE

SHORT-TERM STORAGE

The cable assembly is supplied with a sensor storage container, or sleeve, that attaches to the cable. The container is used for short-term storage (less than 30 days). Be sure to keep a small amount of moisture (tap water) in the container during storage. This is done to maintain a 100% saturated air environment which is ideal for short-term sensor storage. The sensors should not be submersed in water. The intent is to create a humid air storage environment.

LONG-TERM STORAGE

Long-term Storage - Temperature

No special storage is required. The temperature sensor can be stored dry or wet as long as solutions in contact with the thermistor are not corrosive (for example, chlorine bleach).

Long-term Storage Temperature: -5 to 70°C (23 to 158°F)

Long-term Storage - Conductivity

No special storage is required. Sensors can be stored dry or wet as long as solutions in contact with conductivity electrodes are not corrosive (for example, chlorine bleach). However, it is recommended that the sensor be cleaned with the provided brush prior to and after long term storage.

Long-term Storage Temperature: -5 to 70°C (23 to 158°F)

Long-term Storage - Dissolved Oxygen

Dissolved oxygen sensors (Polarographic and Galvanic) should be stored in a dry state for long term storage First, remove the membrane cap and thoroughly rinse the sensor with clean water. Next, either blow it dry with compressed air or allow to air dry completely. Install a clean, dry new membrane cap over the sensor to keep it dry and to protect the electrodes.

After storing the sensor for a long period of time, it is necessary to "condition" the sensor by putting a new membrane with electrolyte solution on the sensor and then turning the instrument on to allow the sensor sufficient time to stabilize.

Long-term Storage Temperature: -5 to 70°C (23 to 158°F)

Long-term Storage - pH

The key to pH sensor storage, short or long-term, is to make certain that the sensor does not dry out. Sensors which have been allowed to dry out due to improper storage procedures may be irreparably damaged by the dehydration and will require replacement. You can try to rehydrate the sensor by soaking it (preferably overnight) in a potassium chloride solution or a pH 4 buffer before attempting to calibrate.

To store the sensor, remove it from the cable and seal the vacant port with a port plug. Fill the original shipping/storage vessel (plastic boot or bottle) with buffer 4 solution and then submerge the sensor into the solution. The sensor should remain submerged in the solution during the storage period; therefore, make certain that the vessel is sealed to prevent evaporation and periodically check the vessel to ensure the sensor does not dry out.

Long-term Storage Temperature: 0 to 30°C (32 to 86°F)

> *It is important not to store the pH sensor in distilled or deionized water as the glass sensor may be damaged by exposure to this medium.*

Long-term Storage - ORP

To store, remove the sensor from the cable and seal the vacant port with the provided plug. Fill the original shipping/storage vessel (plastic boot or bottle) with buffer 4 solution and then submerge the sensor into the solution. The sensor should remain submerged in the solution during the storage period; therefore, make certain that the vessel is sealed to prevent evaporation and periodically check the vessel to ensure the sensor does not dry out.

Long-term Storage Temperature: 0 to 30°C (32 to 86°F)

Long-term Storage - Ammonium, Nitrate, and Chloride

The key to ISE sensor storage, short or long-term, is to make certain that the sensor does not dry out. Sensor junctions that have been allowed to dry out due to improper storage procedures may be irreparably damaged by the dehydration and will require replacement. You can attempt to rehydrate the sensor by soaking it (preferably overnight) in the sensor's high calibration solution before attempting to calibrate.

The recommended storage of these sensors is in moist air. Remove the sensor from the cable and seal the vacant port with the provided plug. Place the sensor in its original shipping storage vessel (plastic boot or bottle) with a small amount of tap water or its high calibration standard. The vessel should remain a saturated air environment. The sensor only needs to be kept in moist air, not submerged. Make certain that the vessel is sealed to prevent evaporation.

Long-term Storage Temperature: 0 to 30°C (32 to 86°F)

TROUBLESHOOTING

Illegal Value may appear during alpha/numeric entry on the message line. This only appears if the values entered do not match the formatting. This will also appear in GLP security area if the password is incorrect.

If you forget the GLP Security Password please contact YSI Tech Support at environmental@ysi.com, 800-897-4151, or +1 937 767-7241.

HELP

During use of the Professional Plus instrument, press **Question** ? from any screen to view help messages directly on the display.

ERROR MESSAGES

If readings for a certain parameter are over range you will see a series of +++++ and if the readings are under range you will see a series of ----- plus the error message along the bottom of the screen. If you see a series of ????? that will indicate that a certain parameter can not be calculated. The following are potential error messages:

Probe Temp over range
Probe Temp under range
Case Temp over range
Case Temp under range
pH over range
pH under range
ORP over range
ORP under range
Cl over range
Cl under range
NH4 over range
NH4 under range
NO3 over range
NO3 under range
DO over range
DO under range
Conductivity over range
Conductivity under range
Barometer over range
Barometer under range

Error messages for the sensors typically indicate a need to properly clean the sensor. First verify the sensor is properly setup in the Sensor menu, then conduct the recommended cleaning and attempt to calibrate the sensor. If this does not work, it may indicate the useful life of the sensor has been reached and may need to be replaced. You may also contact Technical Support to help determine the next step.

DISSOLVED OXYGEN

The dissolved oxygen sensors will use Probe Current (DO uA) and Probe Slope (%/uA) as part of their GLP file records. The following information indicates the acceptable values for each of these readings:

Polarographic DO at 25 °C, 100% saturated air environment at 760 mmHg

Probe Current

1.25 mil PE membrane

Average 6.15 uA (min. 4.31 uA, max. 8.00 uA)

2.0 mil PE membrane

Average 3.38 uA (min. 2.37 uA, max. 4.40 uA)

1 mil Teflon® membrane

Average 16.29 uA (min. 11.40 uA, max. 21.18 uA)

Probe Slope

1.25 mil PE membrane

Average 16.26 % sat/uA (min. 12.51 uA, max. 23.23 uA)

2.0 mil PE membrane

Average 29.56 % sat/uA (min. 22.74 uA, max. 42.23 uA)

1 mil Teflon® membrane

Average 6.14 % sat/uA (min. 4.72 uA, max. 8.77 uA)

RESTORE DEFAULT CALIBRATION VALUES

Occasionally, the instrument may need to have the factory calibration default values restored. In order to accomplish this press Calibrate (Cal), highlight **Restore Default Cal** and press enter. Highlight the parameter you wish to restore to default and press enter. Next you will be asked to confirm the operation. Highlight **Yes** and press enter to confirm.

ACCESSORIES / PART NUMBERS

*Cable Part Number**	*Description*
6050000	Professional Plus Instrument
60510-1, -4, -10, -20, or -30	1, 4, 10, 20, or 30-meter cable for ISE/temp
60520-1, -4, -10, -20, or -30**	1, 4, 10, 20, or 30-meter cable for DO/temp
60530-1, 4, -10, -20, or -30	1, 4, 10, 20 or 30-meter cable for Cond/temp
6051010-1, 4, -10, -20, or -30	1, 4, 10, 20, or 30-meter cable for ISE/ISE/temp
6051020-1, -4, -10, -20, or -30	1, 4, 10, 20, or 30-meter cable for ISE/DO/temp
6051030-1, 4, -10, -20, or -30	1, 4, 10, 20, or 30-meter cable for ISE/Cond/temp
6052030-1, -4, -10, -20, or -30	1, 4, 10, 20 or 30-meter cable for DO/Cond/temp
605790-1, -4, -10, -20, or -30	1, 4, 10, 20 or 30-meter Quatro cable for DO/Cond/temp/ISE/ISE
605107	1-meter pH/temp single junction lab-grade combo electrode
605177	4-meter pH/temp single junction lab-grade combo electrode
605108	1-meter ORP/temp single junction lab-grade combo electrode
605178	4-meter ORP/temp single junction lab-grade combo electrode
605109	1-meter pH/ORP/temp single junction lab-grade combo electrode
605179	4-meter pH/ORP/temp single junction lab-grade combo electrode

Sensor Part Number	*Description*
605202	Galvanic DO sensor
605203	Polarographic DO sensor
605101	pH (ISE)
605102	ORP (ISE)
605103***	pH/ORP Combination (ISE)
605104****	Ammonium (ISE)

Sensor Part Number	*Description*
605105****	Chloride (ISE)
605106****	Nitrate (ISE)
605780	Self-Stirring BOD sensor
005560	Conductivity/Temperature sensor for Quatro cable

* All cables include temperature.
Cables with conductivity include sensor
(no need to order separate conductivity sensor).

** Special order cables up to 100-meters are available with 60520 cables.

*** Not compatible with 6051010-X or Quatro cables.

**** Freshwater only

Accessory Part Number	*Description*
603059	Flow cell, standard, 203 mL (for two-port sensors) 
603077	Flow cell kit, 1 or 2 port sensor (includes 603059 flow cell for two-port sensors with the 603078 adapter for one-port sensors) 
603078	Flow cell adapter, single port (use with 603059 flow cell to accommodate one-port sensors)

Accessory Part Number	*Description*
605990	Flow cell kit for Quatro cable assemblies.
603056	Flow cell mounting spike 
605604	Communications saddle kit 
605515	Data Manager desktop software
603075	Carrying case, soft-sided 
603074	Carrying case, hard-sided 
605745	Maintenance kit
038213	Brush, tube cleaner
601205	Grease, o-ring

Accessory Part Number	*Description*
603069	Belt clip 
063517	Ultra clamp 
063507	Tripod clamp 
603062	Cable management kit 
605978	Weight, sensor/cable, 4.9 oz. 
063019	Weight, sensor/cable, 24 oz., 3"
063020	Weight, sensor/cable, 51 oz., 6"
603070	Shoulder strap

Solutions Part Number	*Description*
3161	1,000 us/cm conductivity solution (quart)
3163	10,000 us/cm conductivity solution (quart)
3169	50,000 us/cm conductivity solution (8 pints)
3682	Zobell ORP solution (125 mL)
3824	pH 4, 7, 10 buffers (2 pints of each)
3841	1 mg/L ammonium solution (500 mL)
3842	10 mg/L ammonium solution (500 mL)
3843	100 mg/L ammonium solution (500 mL)
3885	1 mg/L nitrate solution (500 mL)
3886	10 mg/L nitrate solution (500 mL)
3887	100 mg/L nitrate solution (500 mL)
5580	Confidence Solution (verifies pH, ORP, conductivity sensor performance)

DECLARATION OF CONFORMITY

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms to the requirements for the listed European Council Directive(s) and carries the CE mark accordingly.

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Product Name:	Professional Plus Water Quality Instrument
Model Numbers	
Instrument/Accessory:	Professional Plus (6050000) / ProComm (605604)
Probe/Cable Assemblies:	605107, 605177, 605108, 605178, 605109, 605179, 605780, 60510, 60520, 60530, 6051010, 6051020, 6051030, 6052030, 605790
Sensors:	605202, 605203, 605780, 605101, 605102, 605103, 605104, 605105, 605106, 005560
Conforms to the following:	
Directives:	EMC 2004/108/EC RoHS 2002/95/EC WEEE 2002/96/EC

Harmonized Standards:	• EN61326-1:2006, Electrical equipment for measurement, control, and laboratory use – EMC requirements – Part 1: General Requirements • EN61326-2-3:2006, Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 2-3: Particular Requirements – Test configuration, operational conditions, and performance criteria for transducers with integrated or remote signal conditioning. • EN61000-3-2:2006, Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current < 16A per phase). • EN61000-3-3:1995 +A1:2001 +A2:2005, Electromagnetic compatibility (EMC) – Part 3: Limits – Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current < 16A.
Supplementary Information:	All performance met the continuous unmonitored operation criteria as follows: 1. ESD, EN61000-4-2, Performance Criterion B 2. Radiated Immunity, EN61000-4-3, Performance Criterion A 3. EFT, EN61000-4-4, (EFT) Performance Criterion B 4. Surge, EN61000-4-5, Performance Criterion B 5. Conducted Immunity, EN61000-4-6, Performance Criterion A 6. Voltage Interrupts, EN61000-4-11, Performance Criterion B 7. RF Emissions, EN55011:1998, A1:1999 Class B equipment
Authorized EU Representative	YSI Hydrodata Ltd Unit 8, Business Centre West, Avenue 1 Letchworth, Hertfordshire, SG6 2HB UK

Signed: Lisa M. Abel
Title: Director of Quality

Date: 22 February 2008

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms to the requirements for electrical equipment under US FCC Part 15 and ICES-003 for unintentional radiators.

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Product Name:	
Model Numbers	
Instrument/Accessory:	Professional Plus (6050000) / ProComm (605604)
Probe/Cable Assemblies:	605107, 605177, 605108, 605178, 605109, 605179, 605780, 60510, 60520, 60530, 6051010, 6051020, 6051030, 6052030, 605790
Sensors:	605202, 605203, 605780, 605101, 605102, 605103, 605104, 605105, 605106, 005560
Conforms to the following:	
Standards:	• FCC 47 CFR Part 15-2008, Subpart B, Class B, Radio Frequency Devices • ICES-003:2004, Digital Apparatus
Supplementary Information:	Tested using ANSI C63.4-2003 (excluding sections 4.1, 5.2, 5.7, 9, and 14)

Signed: Lisa M. Abel
Title: Director of Quality

Date: 22 February 2008

The undersigned hereby declares on behalf of the named manufacturer under our sole responsibility that the listed product conforms with the Australian and New Zealand Electromagnetic Compatibility (EMC) requirements for generic products to be used in residential, commercial, and light industrial environments.

Manufacturer:	YSI Incorporated 1725 Brannum Lane Yellow Springs, OH 45387 USA
Product Name:	Professional Plus Water Quality Instrument
Model Numbers	
Instrument/Accessory:	Professional Plus (6050000) / ProComm (605604)
Probe/Cable Assemblies:	605107, 605177, 605108, 605178, 605109, 605179, 605780, 60510, 60520, 60530, 6051010, 6051020, 6051030, 6052030, 605790
Sensors:	605202, 605203, 605780, 605101, 605102, 605103, 605104, 605105, 605106, 005560
Conforms to the following:	
Standards:	• AS/NZS 4251.1:1999, Electromagnetic Compatibility (EMC) – Generic emission standard – Part 1: Residential, commercial, and light industry.

Signed: Lisa M. Abel Date: 22 February 2008
Title: Director of Quality

RECYCLING

YSI is committed to reducing the environmental footprint in the course of doing business. Even though materials reduction is the ultimate goal, we know there must be a concerted effort to responsibly deal with materials after they've served a long, productive life-cycle. YSI's recycling program ensures that old equipment is processed in an environmentally friendly way, reducing the amount of materials going to landfills.

- Printed Circuit Boards are sent to facilities that process and reclaim as much material for recycling as possible.
- Plastics enter a material recycling process and are not incinerated or sent to landfills.

- Batteries are removed and sent to battery recyclers for dedicated metals.

When the time comes for you to recycle, follow the easy steps outlined at www.ysi.com.

CONTACT INFORMATION

ORDERING AND TECHNICAL SUPPORT

Telephone: 800 897 4151 (US)
+1 937 767 7241 (Globally)
Monday through Friday, 8:00 AM to 5:00 ET

Fax: +1 937 767 9353 (orders)
+1 937 767 1058 (technical support)

Email: environmental@ysi.com or proseries@ysi.com

Mail: YSI Incorporated
1725 Brannum Lane
Yellow Springs, OH 45387 USA

Internet: www.ysi.com

When placing an order please have the following available:
1.) YSI account number (if available)
2.) Name and phone number
3.) Purchase Order or Credit Card
4.) Model Number or brief description
5.) Billing and shipping addresses
6.) Quantity Telephone: 800 897 4151 (US)

SERVICE INFORMATION

YSI has authorized service centers throughout the United States and Internationally. For the nearest service center information, please visit www.ysi.com and click 'Support' or contact YSI Technical Support directly at 800-897-4151.

When returning a product for service, include the Product Return form with cleaning certification. The form must be completely filled out for a YSI Service Center to accept the instrument for service. The form may be downloaded from www.ysi.com by clicking on the 'Support" tab, then the Product Return Form button.

APPENDIX 4

Permit to Take Protected Species for Scientific Purposes, Permit No. 1580-01

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

Martin Daley
Dynegy Northeast Generation, Inc.
992-994 River Road
Newburgh, New York 12550

JUN 2 2008

Dear Mr. Daley:

Enclosed is Modification No. 1 to Permit No. 1580, which authorizes you to conduct biological sampling of up to 82 juvenile and adult shortnose sturgeon (*Acipenser brevirostrum*), in addition to the collection (lethal take) of up to 40 shortnose sturgeon larvae, in the Hudson River (Battery Park to River Mile 152). The enclosed modification changes the annual report due date in addition to associated reporting conditions. All other aspects of the permit will remain the same. Please note the new permit number (Permit No. 1580-01) and the amended portions that appear in **bold** type. This version of your permit supersedes all previous versions and should be used by you and all Co-Investigators. This permit is effective upon your signature and valid through the expiration date indicated in Condition A.1.

Both an original and a "file copy" of the signature page are enclosed with your permit. Please sign and date both pages, where indicated, keeping the original with the permit for your records. You must return the "file copy" signature page, with your dated signature, to this office as proof of your acceptance of the permit. Please return the signature page marked "file copy" to the Chief, Permits Division (F/PR1), 1315 East-West Highway, Silver Spring, MD 20910. You may also submit the "file copy" of the signature page by facsimile to 301-427-2521 and confirm it by mail.

As Holder of this permit, you are ultimately responsible for all activities of any individual operating under its authority. Therefore, you should read all sections of the permit carefully before signing it and before conducting any activities pursuant to the permit. If you have any problems or questions, please contact Brandy Belmas or Malcolm Mohead at (301) 713-2289 before signing the permit.

Sincerely,

P. Michael Payne
Chief, Permits, Conservation
and Education Division
Office of Protected Resources

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

Permit No. 1580-01
Expiration Date: March 31, 2012
Reports Due: **March 31**, annually

PERMIT TO TAKE PROTECTED SPECIES[1] FOR SCIENTIFIC PURPOSES
Modification No. 1

I. Authorization

This permit is issued to Dynegy Northeast Generation, Inc. (hereinafter "Permit Holder"), 992-994 River Road, Newburgh, New York 12550, [Responsible Party: Martin Daley], pursuant to the provisions of the Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 et seq.), and the regulations governing the taking, importing, and exporting of endangered and threatened species (50 CFR Parts 222-226). **This permit, as modified, supersedes all previous versions.**

II. Abstract

The objectives of the permitted activity, as described in the application, are to evaluate the life history, population trends, and spatial, temporal, and size distribution of shortnose sturgeon (*Acipenser brevirostrum*) collected during the annual Hudson River Biological Monitoring Program (BMP). This program is conducted in compliance with the regulatory requirements of the Clean Water Act, and those set forth by the State Pollution Discharge Elimination System (SPDES) permit possessed by the Permit Holder.

III. Terms and Conditions

The activities authorized herein must occur by the means, in the areas, and for the purposes set forth in the permit application, and as limited by the Terms and Conditions specified in this permit, including all attachments and appendices. Any permit noncompliance constitutes a violation and is grounds for permit modification, suspension, or revocation, and for enforcement action.

A. Duration of Permit

1. Personnel listed in Condition C.1 of this permit (hereinafter "Researchers") may conduct activities authorized by this permit through March 31, 2012. This permit expires on the date indicated and is non-renewable. This permit may be extended by the Director, NMFS Office of Protected Resources, pursuant to applicable regulations and the requirements of the ESA.

[1] "Protected species" include species listed as threatened or endangered under the ESA, and marine mammals.

2. Researchers must suspend all permitted activities in the event serious injury[2] or mortality[3] of shortnose sturgeon reaches that specified in Appendix 1. The Permit Holder must contact the Chief, NMFS Permits, Conservation and Education Division (hereinafter "Permits Division") by phone (301-713-2289) within two business days. The Permit Holder must also submit a written incident report as described in Condition E.2. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of this permit.

3. If authorized take[4] is exceeded, Researchers must cease all permitted activities and notify the Chief, Permits Division by phone (301-713-2289) as soon as possible, but no later than within two business days. The Permit Holder must also submit a written incident report as described in Condition E.2. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of this permit.

B. Number and Kind(s) of Protected Species, Location(s), and Manner of Taking

1. The table in Appendix 1 outlines the number of shortnose sturgeon authorized to be taken and the locations, manner, and time period in which they may be taken.

2. Researchers working under this permit may collect visual images (i.e., any form of still photographs and motion pictures) as needed to document the permitted activities, provided the collection of such images does not result in takes of protected species.

   a. The Permit Holder may use these images in printed materials (including commercial or scientific publications) and presentations provided the images are accompanied by a statement indicating that the activity depicted was conducted pursuant to Permit No. 1580. This statement must accompany the images in all subsequent uses or sales.

   b. Annual reports required pursuant to Condition E.3 must note such incidental scientific, educational, or commercial uses of the images.

3. Upon written request from the Permit Holder, approval for photography, filming, or audio recording activities not essential to achieving the objectives of the permitted activities, including allowing personnel not essential to the research

[2] A serious injury is defined by regulation as any injury that will likely result in mortality.
[3] This permit does not allow for unintentional serious injury and mortality caused by the presence or actions of researchers. This includes, but is not limited to; deaths of dependant young by starvation following research-related death of a lactating female; deaths resulting from infections related to sampling procedures; and deaths or injuries sustained by animals during capture and handling, or while attempting to avoid researchers or escape capture.
[4] Under the ESA, a take means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to do any of the preceding.

(e.g. a documentary film crew) to be present, may be granted by the Chief, Permits Division.

a. Where such non-essential photography, filming, or recording activities are authorized they must not influence the conduct of permitted activities in any way or result in takes of protected species.

b. Personnel authorized to accompany the Researchers during permitted activities for the purpose of non-essential photography, filming, or recording activities are not allowed to participate in the permitted activities.

c. Annual reports required pursuant to Condition E.3 must note such non-essential activities.

d. The Permit Holder and Researchers cannot require or accept compensation in return for allowing non-essential personnel to accompany Researchers to conduct non-essential photography, filming, or recording activities.

4. Researchers must comply with the following conditions related to the manner of taking:

   a. Capture

      i. Ichthyoplankton, beam, and otter trawl nets:

         1. Nets must be towed at a maximum speed of 5 miles per hour for no more than 10 minutes.

         2. A depth sounder must be used to monitor the bottom characteristics. If the net becomes snagged (on bottom substrate, debris, etc.), it must be untangled immediately to reduce stress on the animals.

         3. A Global Positioning System (GPS) must be used to determine the coordinates of each tow. Trawling over the same exact location more than once in a 24 hour period is not permitted.

      ii. Beach seine:

         1. Seining must be conducted only in areas of smooth substrate.

   b. Handling

      i. Handling time of shortnose sturgeon must not exceed 15 minutes.

ii. Fish must be handled with care and kept in water to the maximum extent possible during sampling and processing procedures. To reduce stress, all fish handled out-of-water must be transferred using a sanctuary net that holds water during transfer.

iii. For weight measurements, sturgeon must be supported using a sling or net and handling should be minimized throughout the procedure. Smooth rubber gloves must be worn to reduce abrasion of skin and removal of mucus.

iv. Before release, fish must be treated with an electrolyte bath to help reduce stress and restore slime coat.

c. Holding

i. Total holding time of any shortnose sturgeon, after removal from the net, must not exceed two hours when water temperatures are $\leq 27^{\circ}C$; if temperatures are $\geq 27^{\circ}C$, holding of shortnose sturgeon must not exceed 30 minutes.

ii. Sturgeon must be held in floating net pens or live cars during processing.

iii. When fish are onboard the research vessel, they must be placed in flow-through tanks that allow for total replacement of water volume every 15-20 minutes. Dissolved oxygen levels in holding tanks must be maintained above 5 ppm.

iv. To remove chlorine, thoroughly flush holding tanks sterilized with bleach between sampling periods.

d. Genetic Sampling

i. Collection of genetic samples (fin clip) must be coordinated with Julie Carter (NOAA-NOS) (843)762-8547.

ii. Extreme care must be used when collecting genetic samples. Instruments must be sterilized and gloves must be changed between each fish sampled to avoid possible disease transmission or cross contamination of genetic material.

e. Tagging

i. Prior to placement of PIT tags, the entire dorsal surface of each fish must be scanned with a PIT tag reader to ensure detection of fish tagged in other studies. Previously tagged fish must not be retagged.

ii. PIT tags must be inserted immediately anterior to the dorsal fin of the sturgeon.

iii. Researchers would not insert PIT tags larger than 11.5 mm x 2.1 mm into juvenile shortnose sturgeon less than 330 mm in length.

iv. Shortnose sturgeon less than 250 mm (10 inches) must not be tagged.

v. Total weight of all tags (internal and external) must not exceed 2% of the fish's total body weight.

f. Atlantic Sturgeon

i. If an Atlantic sturgeon is incidentally captured, it must be PIT tagged (according to the procedures indicated above), genetically sampled (1 cm^2 pelvic fin clip), and released.

ii. The Permit Holder must report any sturgeon interactions to Northeast Regional Office, NMFS, Kim Damon Randall at 978-281-9300 x6535; Kimberly.Damon-Randall@noaa.gov. This report must contain: the description of the take, location, and final disposition of the sturgeon (i.e., released in good health, etc.).

C. Qualifications, Responsibilities, and Designation of Personnel

1. The following Researchers may participate in the conduct of the permitted activities in accordance with their qualifications and the limitations specified herein:

a. Responsible Party – Martin Daley;

b. Principal Investigator – Mark Mattson; and

c. Co-Investigator(s) – Michael Ricci, Christopher Burnett, Charles Sweeney, Scott Shanke, William Furman.

2. Individuals conducting permitted activities must possess qualifications commensurate with their roles and responsibilities. The roles and responsibilities of personnel operating under this permit are as follows:

a. The Permit Holder is ultimately responsible for all activities of any individual who is operating under the authority of this permit. Where the Permit Holder is an institution/facility, the Responsible Party is the person at the institution/facility who is responsible for the supervision of the Principal Investigator.

b. The Principal Investigator (PI) is the individual primarily responsible for the taking, import, export and any related activities conducted under the

permit. The PI must be on site during any activities conducted under this permit unless a Co-Investigator named in Condition C.1 is present to act in place of the PI.

c. Co-Investigators (CIs) are individuals who are qualified to conduct activities authorized by the permit without the on-site supervision of the PI. CIs assume the role and responsibility of the PI in the PI's absence.

d. Research Assistants (RAs) are individuals who work under the direct and on-site supervision of the PI or a CI. RAs cannot conduct permitted activities in the absence of the PI or a CI.

3. Personnel involved in permitted activities must be reasonable in number and essential to conduct of the permitted activities. Essential personnel are limited to:

a. Individuals who perform a function directly supportive of and necessary to the permitted activity (including operation of any vessels or aircraft essential to conduct of the activity);

b. Individuals included as backup for those personnel essential to the conduct of the permitted activity; and

c. Individuals included for training purposes.

4. Persons who require state or Federal licenses to conduct activities authorized under the permit (*e.g.*, veterinarians, pilots) must be duly licensed when undertaking such activities.

5. Permitted activities may be conducted aboard vessels or aircraft, or in cooperation with individuals or organizations, engaged in commercial activities, provided the commercial activities are not conducted simultaneously with the permitted activities, except with written approval pursuant to Condition B.3.

6. The Permit Holder may request authorization from the Chief, Permits Division to add personnel to this permit as indicated below. The Permit Holder cannot require or receive any direct or indirect compensation in return for requesting authorization for such person to act as a PI, CI, or RA under the permit.

a. The Permit Holder or PI may add or remove CIs from the permit by submitting a written request to the Chief, Permits Division. Where the Permit Holder is an institution/facility, the Responsible Party may request a change of PI. Requests to change the PI or add CIs must include a description of the individual's qualifications to conduct and oversee the activities authorized under this permit.

D. Possession of Permit

1. This permit cannot be transferred or assigned to any other person.

2. The Permit Holder and all other persons operating under the authority of this permit must possess a copy of this permit: when engaged in a permitted activity; when a protected species is in transit incidental to a permitted activity; and during any other time when any protected species taken under such permit is in the possession of such persons.

3. A duplicate copy of this permit must be attached to the container, package, enclosure, or other means of containment in which a protected species or protected species part is placed for purposes of storage, transit, supervision or care.

E. Reports

1. The Permit Holder must submit annual, final, and incident reports, and any papers or publications resulting from the research authorized herein to the Chief, Permits Division, Office of Protected Resources, NMFS, 1315 East-West Highway, Suite 13705, Silver Spring, MD 20910; phone (301) 713-2289; fax (301) 427-2521.

2. Written incident reports related to serious injury and mortality events or to exceeding authorized takes, must be submitted to the Chief, Permits Division within two weeks of the incident. The incident report must include a complete description of the events and identification of steps that will be taken to reduce the potential for additional research-related mortality or exceedance of authorized take.

3. An annual report must be submitted to the Chief, Permits Division by **March 31** for each year the permit is valid. The annual report describing activities conducted during the previous permit year must follow the format in Appendix 2.

   a. Since larval samples collected during surveys would not be analyzed by the date annual reports are due (March 31), an estimate of the number of larvae collected must be provided, including a description of how this estimate was derived. Each annual report must be followed by an interim report containing the *actual* number of larvae collected during the previous field season.

i. **Interim reports, containing the actual number of larvae collected, must be submitted to the Chief, Permits Division no later than July 1 (of the following year) for the previous field season. The interim reports must follow the format in Appendix 2.**

4. A final report must be submitted to the Chief, Permits Division within 180 days after expiration of the permit (September 30, 2012), or, if the research concludes prior to permit expiration, within 180 days of completion of the research. The final report must follow the format in Appendix 2.

5. Research results must be published or otherwise made available to the scientific community in a reasonable period of time.

F. Notification and Coordination

1. The Permit Holder must provide written notification of planned field work to the appropriate Assistant Regional Administrator for Protected Resources at the address listed below. Such notification must be made at least two weeks prior to initiation of any field trip/season and must include the locations of the intended field study and/or survey routes, estimated dates of research, and names and roles of participants (i.e., all CIs and Research Assistants).

   Northeast Region, NMFS, One Blackburn Drive, Gloucester, MA 01930-2298; phone (978) 281-9300; fax (987) 281-9394.

2. To the maximum extent practical, the Permit Holder must coordinate permitted activities with activities of other Permit Holders conducting the same or similar activities on the same species, in the same locations, or at the same times of year to avoid unnecessary disturbance of animals. The appropriate Regional Office may be contacted at the address listed above for information about coordinating with other Permit Holders.

G. Observers and Inspections

1. NMFS may review activities conducted pursuant to this permit. At the request of NMFS, the Permit Holder must cooperate with any such review by:

   a. Allowing any employee of NOAA or any other person designated by the Director, NMFS Office of Protected Resources to observe permitted activities; and

   b. Providing any documents or other information relating to the permitted activities.

H. Modification, Suspension, and Revocation

1. All permits are subject to suspension, revocation, modification, and denial in accordance with the provisions of subpart D [Permit Sanctions and Denials] of 15 CFR part 904.

2. The Director, NMFS Office of Protected Resources may modify, suspend, or revoke this permit in whole or in part:

   a. In order to make the permit consistent with any change made after the date of permit issuance with respect to any applicable regulation prescribed under section 4 of the ESA;

   b. In any case in which a violation of the terms and conditions of the permit is found;

   c. In response to a written request[5] from the Permit Holder;

   d. If NMFS determines that the application or other information pertaining to the permitted activities (including, but not limited to, reports pursuant to Section E of this permit and information provided to NOAA personnel pursuant to Section G of this permit) includes false information; and

   e. If NMFS determines that the authorized activities will operate to the disadvantage of threatened or endangered species or are otherwise no longer consistent with the purposes and policy in Section 2 of the ESA.

3. Issuance of this permit does not guarantee or imply that NMFS will issue or approve subsequent permits or amendments for the same or similar activities requested by the Permit Holder, including those of a continuing nature.

I. Penalties and Permit Sanctions

1. Any person who violates any provision of this permit, the ESA, or the regulations at 50 CFR 222-226 is subject to civil and criminal penalties, permit sanctions, and forfeiture as authorized under the ESA, and 15 CFR part 904.

2. NMFS shall be the sole arbiter of whether a given activity is within the scope and bounds of the authorization granted in this permit. The Permit Holder must contact the Permits Division for verification before conducting the activity if they

[5] The Permit Holder may request changes to the permit related to: the objectives or purposes of the permitted activities; the species or number of animals taken; and the location, time, or manner of taking or importing protected species. Such requests must be submitted in writing to the Chief, Permits Division in the format specified in the application instructions.

are unsure whether an activity is within the scope of the permit. Failure to verify, where NMFS subsequently determines that an activity was outside the scope of the permit, may be used as evidence of a violation of the permit, the ESA, and applicable regulations in any enforcement actions.

J. Acceptance of Permit

1. In signing this permit, the Permit Holder and Principal Investigator:

   a. Agree to abide by all terms and conditions set forth in the permit, all restrictions and relevant regulations under 50 CFR Parts 222-226, and all restrictions and requirements under the ESA;

   b. Acknowledge that the authority to conduct certain activities specified in the permit is conditional and subject to authorization by the Office Director; and

   c. Acknowledge that this permit does not relieve the Permit Holder of the responsibility to obtain any other permits, or comply with any other Federal, State, local, or international laws or regulations.

for James H. Lecky
Director, Office of Protected Resources
National Marine Fisheries Service

May 29, 2008
Date

Martin Daley
Senior Director-Regulatory and Administrative Services
Dynegy Northeast Generation, Inc.
Responsible Party

June 19, 2008
Date

Mark Mattson
Vice President/Principal Aquatic Ecologist
Normandeau Associates, Inc.
Principal Investigator

27 JUNE 2008
Date

Appendix 1
Authorized Takes

Table 1. Activities Authorized Under Permit No. 1580-01, annually.						
Number of Individuals	**Species**	**Life Stage**	**Sex**	**Take Activity**	**Location**	**Date(s)**
82	shortnose sturgeon (*Acipenser brevirostrum*)	juvenile & adult	male & female	capture, handle, measure, weigh, scan for tags, PIT tag, Carlin tag, photograph, tissue sample, and release	Hudson River, NY (Battery Park – RM 152)	January - December
40	shortnose sturgeon (*Acipenser brevirostrum*)	larvae	male & female	lethal take	Hudson River, NY (Battery Park – RM 152)	March – December

Appendix 2
Protected Species Research or Enhancement Permit
Report Form

Date: _____ **Reporting Period:** _____

Permit Number: _____ **Permit Holder's Name:** _____

Contact Name: _____ **Contact Email:** _____
Contact Phone #: _____
(Contact = person submitting report)

Part I: Take Table. Enter the actual number of animals taken during this reporting period.

Activities Authorized Under Permit No. 1580-01, annually.							
Number of Individuals	**Actual Number of Animals Taken**	**Species**	**Life Stage**	**Sex**	**Take Activity**	**Location**	**Date(s)**
82		shortnose sturgeon (*Acipenser brevirostrum*)	juvenile & adult	male & female	capture, handle, measure, weigh, scan for tags, PIT tag, Carlin tag, photograph, tissue sample, and release	Hudson River, NY (Battery Park – RM 152)	January - December
40		shortnose sturgeon (*Acipenser brevirostrum*)	larvae	male & female	lethal take	Hudson River, NY (Battery Park – RM 152)	March – December

NOTE: If you conducted activities or took protected species for which you were not authorized, you must enter them on separate lines of the table and explain exactly what happened (see Part II below).

Part II: **Narrative.** Briefly provide the following information:

Effects permitted activities had on animals, including any unforeseen responses or effects.

Measures taken to minimize effects of permitted activities on animals and the effectiveness of these measures.

The physical condition of animals taken and used in the permitted activities.

How permitted species were unintentionally injured or killed and how they were disposed.

Any problems that were encountered during the permitted activities and any steps taken or proposed to resolve such problems.

Steps taken to coordinate the permitted activities with other permit holders.

Summarize any preliminary findings. Did you accomplish the goals of your permitted activities?

List titles of reports, publications, etc. resulting from this reporting period. Attach copies of any final documents as available. If these documents are not yet available, indicate when you anticipate that they will be completed and submitted. When reports and publications are available, send to the Chief, Permits Division, and include the permit number in subject line.

Number and type of non-permitted species caught, harassed, or otherwise taken, and the observed effects of such taking.

Any incidental photography or filming.

Any additional findings, results, or information you would like to report or comment on.

If you have any questions, please contact the permit analyst listed on the cover letter of your permit. Please submit this form electronically to the same permit analyst.

Instructions: Collecting, Certifying, Identifying &Shipping Tissue Samples Collected from Sturgeon.

1. **Species Certification**:
For each shipment a "*Certification of Species Identification*" (Section A) must be provided. This form documents the collector has identified the fish or fishes sampled in the shipment as either a shortnose or Atlantic sturgeon. If there is any doubt about the identity of a sample, then mark unknown and include comments on the take.

2. **Sample Identification**:
Assign a unique number identifying each individual fish captured and subsequently sampled. This number must be recorded in Section B and on the collection vial for each sample taken. Record tissue type; preservative used; date of capture; location of capture (river & description, lat/long, river km, and nearest city); length of specimen; weight; and sex, if known. Check the box provided if you are submitting multiple samples, and provide a hard-copy and/or email a copy of the sample spreadsheet with information for each of the data fields listed above.

3. **Tissue Sampling Instructions:**
a. Cleanliness of Samples: Cross contamination should be avoided. For each fish, use a clean cutting tool, syringe, etc. for collecting and handling samples.

b. Preserving & Packaging Samples:
   i. Label vial with fish's unique ID number.
   ii. Place a 1-2 cm^2 section of pelvic fin clip in vial with preservative (95% absolute ETOH (un-denatured), recommended).
   iii. Seal individual vials or containers with leak proof positive measure (e.g., tape).
   iv. Package vials and absorbent within a double sealed container (e.g., zip lock baggie).
   v. Label air package properly identifying ETOH warning label (**See Appendix 3c**).

c. Shipping Instructions:
When shipping samples, place separately Appendix 3a, 3b and 3c (Sample ID and Chain of Custody Forms and Shipping Training Form) in container and seal the shipping box to maintain the chain of custody. (Note: A copy of the ESA permit authorizing the collection of the sample(s) must also accompany the sample(s)).

Important Notice: You must be certified before shipping tissue samples preserved with 95% ETOH in "excepted quantities" (A Class 3 Hazardous Material Due to Flammable Nature). See Appendix 3c: "NMFS Guidelines for Air-Shipment of Excepted Quantities of Ethanol Solutions" to comply with the DOT/IATA federal regulations.

4. **Chain of Custody Instructions:**
The "*Chain of Custody*" (Section C) should be maintained for each shipment of tissue samples and must accompany the sample(s) at all times. To maintain the chain of custody, when sample(s) are transferred, the sample(s) and the documentation should be packaged and sealed together to ensure that no tampering has occurred. All subsequent handlers breaking the seal must also sign and document the chain of custody section.

5. **Contact Information**:
A. **NMFS, Office of Protected Resources**:
   i. **Primary Contact**: Malcolm Mohead (malcolm.mohead@noaa.gov) Phone: 301/713-2289
   ii. **Primary Contact:** Colette Cairns (colette.cairns@noaa.gov) Phone: 301/713-2289
   i. **Secondary Contact: (Northeast)** Jessica Pruden (jessica.pruden@noaa.gov) Phone: 978/281-9300
   ii. **Secondary Contact: (Southeast)** Stephania Bolden (stephania.bolden@noaa.gov) Phone: 727/824-5312

B. **NOS Archive:**
   i. **Primary Contact**: Julie Carter (julie.carter@noaa.gov) Phone: 843/762-8547

Appendix 3a:

Certification, Identification and Chain of Custody Form for Submitting Sturgeon Genetic Tissue Samples.[1],[2]

(A) CERTIFICATION OF SPECIES (Collector)

I, _____, hereby certify that I have positively identified the
Full Name

fish or fishes sampled in this shipment as: ☐ shortnose sturgeon; ☐ Atlantic sturgeon; ☐ other ☐ unknown
based on my knowledge and experience as a _____.
Position Job Title

Signature: _____ Date Identified: _____
Address: _____
_____
Phone Number: _____

(B) SAMPLE IDENTIFICATION

Species Identification: ☐ shortnose sturgeon; ☐ Atlantic sturgeon; ☐ unknown
Unique ID No: _____; Tissue Type: _____; Preservative: _____;
Location: (River: _____; River-km: _____; Lat/Long: _____;
River Location Description: _____);
Total Length (TL) of Specimen (mm): _____ Weight of Specimen (g): _____; Sex (if known) _____

Specific comments on take: _____
_____

☐ Check here if multiple samples are submitted and use *Field Collection Report* (Appendix 3b) with the data fields listed in this section.

(C) EVIDENCE OF CHAIN OF CUSTODY

1.	_____ Release Signature	_____ NMFS Permit No.	_____ Method of Transfer	_____ Date
	_____ Receipt Signature	_____ NMFS Permit No.		_____ Date
2.	_____ Release Signature	_____ NMFS Permit No.	_____ Method of Transfer	_____ Date
	_____ Receipt Signature	_____ NMFS Permit No.		_____ Date
3.	_____ Release Signature	_____ NMFS Permit No.	_____ Method of Transfer	_____ Date
	_____ Receipt Signature	_____ NMFS Permit No.		_____ Date

[1] Instructions on next page.
[2] If multiple samples are shipped, attach summary sheet in Appendix 3b.

Appendix 3b Summary Sheet for Genetic Tissue Samples [1,2]

Date	Species	Unique ID.	Genetic Tissue Type	Preservative	Location: (River)	Location (River km)	Location (Lat/Long)	Total Length (mm)	Weight (g)	Sex	Comments

1. Please coordinate with NMFS to receive a file copy of this appendix in spreadsheet format.
2. If multiple samples are shipped, attach this form (and disk copy) to supplement Appendix 3a.

Appendix 3c

NMFS Guidelines for Air-Shipment of "Excepted Quantities" of Ethanol Solutions

These guidelines have been adapted with permission from the University of New Hampshire-Office of Environmental Health & Safety; our appreciation is to Andy Glode for providing reference materials upon which this guide was created.

The U.S. Department of Transportation (DOT: 49 CFR 173.4) and the International Air Transport Association (IATA: 2007 Dangerous Goods Regulations, Sec. 2.7) regulate shipments of ethanol (ETOH) in *excepted quantities*. As a result, specific procedures must be followed as well as certifying proper training of individuals prior to packaging and shipping specimens preserved in ETOH. These guidelines will inform proper shipping and also satisfy certifying requirements. Failure to meet such requirements could result in regulatory fines and/or imprisonment.

Therefore, prior to submitting ETOH preserved samples and appropriate documentation (*e.g.*, a FedEx Airbill) to a carrier, please read, initial and sign this document, affirming you have understood the requirements as outlined. Please include this document in the shipping package and retain a copy for your records.

1) Packages and documents submitted to a carrier must not contain any materials other than those described in this document (*i.e.* containers holding ethanol-preserved specimens and related absorbent and packaging materials). Also, laboratory or sampling equipment, *unrelated documents*, or other goods must be packaged and shipped in separate boxes. (Note: ETOH solutions are not permitted to be transported in checked baggage, carry-on baggage, or airmail.) **I understand (_____)**

2) Please read the manufacturer's Material Safety Data Sheet (MSDS) for ETOH recognizing ETOH (55 - 100%) is classed as hazardous flammable material (NFPA Rating = 3). Note also, its vapor is capable of traveling a considerable distance to an ignition source causing "flashback." Properly packaging and labeling shipments of ethanol solutions will minimize the chance of leakage, and would also communicate the potential hazard to transport workers in the event of a leak. **I understand (_____)**

a) **Quantity Limits**: Small quantities (inner container less than 30 ml, with a maximum net quantity of 500 ml for the entire package) of ETOH can be shipped with "Excepted Quantities" labels without completion of a Dangerous Goods Declaration. (e.g., If shipping vials having a maximum volume of 10 ml each, you may put up to 50 vials in one box.) **I understand (_____)**

b) **Package Components**:

i. ***Inner (primary) packaging (e.g., vial, tube, jar, etc.)***: Do not completely fill inner packaging; allow 10% head-space for liquid expansion. Liquids must not completely fill inner packaging at a temperature of 55°C (130°F). Closures of inner packaging (e.g., vials with tops) must be held securely in place with tape or other positive means. **I understand (_____)**

ii. ***Intermediate (secondary) packaging (e.g. Ziplock or other plastic bag)***: Place inner container(s) (*e.g.,* vials with ETOH) into a high-quality plastic bag. Then add an absorbent material capable of absorbing any spillage without reacting with the ethanol. Seal the first bag tightly and then tape the locking seals. Next, seal the inner bag within a second bag for added safety. **I understand (_____)**

iii. ***Outer packaging (e.g., cardboard box)***: Ethanol solutions may not be shipped in envelopes, Tyvek® sleaves, or other non-rigid mailers. The dimensions of the outer box must be at least 100 mm (~4 inches) on two sides. Any space between the inner packing containers placed in the outer packaging should be eliminated with additional filler. **I understand (_____)**

c) **Package Labels**:

i. ***Dangerous Goods in Excepted Quantities Label*** **(Figure 1.)**: The label must display a "3" as the ethanol hazard class number using a black marker. You may obtain self-adhesive labels from NMFS, or else, order online. **I understand (_____)**

ii. ***Name and Address:*** The outer container must display the name and address of the shipper and consignee. When re-using shipping boxes, completely remove or black out all unnecessary labels or marks. **I understand (_____)**

Figure 1. Dangerous Goods in Excepted Ouantities label

Appendix 3c (continued)

d) **Package Tests:**

A representative example of packaging used for excepted quantities of ethanol solutions must pass a drop test and compressive load test without any breakage or leakage of any inner packaging and without any significant reduction in package effectiveness. Perform the following tests on a representative example of your packaging and keep a record of the results.

i. ***Drop Test***: Drop a representative package from a height of 1.8 m (5.9 feet) directly onto a solid unyielding surface:

		Test Results
a.	One drop flat on the base;	(_____)
b.	One drop flat on top;	(_____)
c.	One drop flat on the longest side;	(_____)
d.	One drop flat on the shortest side; and	(_____)
e.	One drop on a corner.	(_____)

ii. ***Compressive Load Test***: Apply a force to the top surface of a representative package for a duration of 24 hours, equivalent to the total weight of identical packages if stacked to a height of 3 meters. (_____)

e) **Package Documentation:**

Proper documentation is required for all shipments of hazardous materials. Incorrect documentation is the most common cause for package refusal. If using documentation for couriers other than FedEx, UPS and DHL, please contact NMFS for assistance.

i. ***FedEx***: For domestic shipments with FedEx Express, fill out the standard US Airbill. Fill out the form completely including the following information:

a. In Section 6, Special Handling, check the box "Yes, Shipper's Declaration not required."
b. On the top of the form above the FedEx tracking number, include the statement, "***Dangerous Goods in Excepted Quantities***" See example in **Figure 2.** **I understand (_____)**

ii. ***DHL:*** The "*Nature and Quantity of Goods*" box of the air waybill must include "**Dangerous Goods in Excepted Quantities.**" **I understand (_____)**

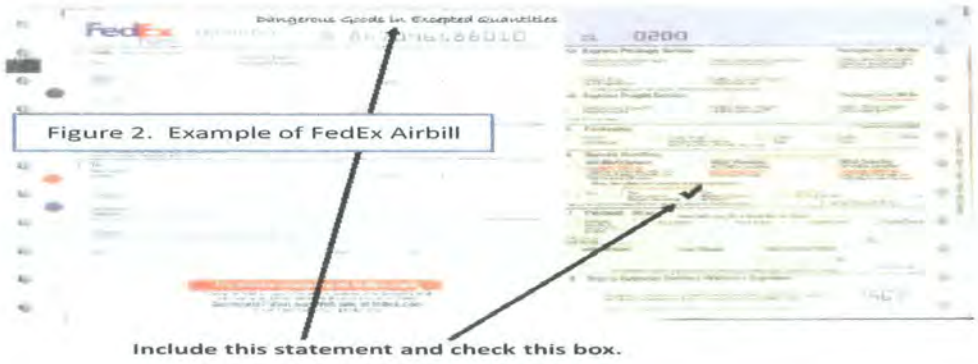


Figure 2. Example of FedEx Airbill

By signing this document, I affirm I understand the hazards associated with ethanol and the shipping requirements for ethanol solutions, as outlined in this guide. I also understand I am required to include a copy of this document in the package and that it should be appended to an ESA permit (if listed samples are shipped).

Print Name:		Signature:	
Employer:		Employer Address:	
Date:			Phone:

Appendix 3c

NMFS Guidelines for Air-Shipment of "Excepted Quantities" of Ethanol Solutions

These guidelines have been adapted with permission from the University of New Hampshire-Office of Environmental Health & Safety; our appreciation is to Andy Glode for providing reference materials upon which this guide was created.

The U.S. Department of Transportation (DOT: 49 CFR 173.4) and the International Air Transport Association (IATA: 2007 Dangerous Goods Regulations, Sec. 2.7) regulate shipments of ethanol (ETOH) in *excepted quantities*. As a result, specific procedures must be followed as well as certifying proper training of individuals prior to packaging and shipping specimens preserved in ETOH. These guidelines will inform proper shipping and also satisfy certifying requirements. Failure to meet such requirements could result in regulatory fines and/or imprisonment.

Therefore, prior to submitting ETOH preserved samples and appropriate documentation (*e.g.*, a FedEx Airbill) to a carrier, please read, initial and sign this document, affirming you have understood the requirements as outlined. Please include this document in the shipping package and retain a copy for your records.

1) Packages and documents submitted to a carrier must not contain any materials other than those described in this document (*i.e.* containers holding ethanol-preserved specimens and related absorbent and packaging materials). Also, laboratory or sampling equipment, *unrelated documents*, or other goods must be packaged and shipped in separate boxes. (Note: ETOH solutions are not permitted to be transported in checked baggage, carry-on baggage, or airmail.) **I understand (_____)**

2) Please read the manufacturer's Material Safety Data Sheet (MSDS) for ETOH recognizing ETOH (55 - 100%) is classed as hazardous flammable material (NFPA Rating = 3). Note also, its vapor is capable of traveling a considerable distance to an ignition source causing "flashback." Properly packaging and labeling shipments of ethanol solutions will minimize the chance of leakage, and would also communicate the potential hazard to transport workers in the event of a leak. **I understand (_____)**

a) **Quantity Limits**: Small quantities (inner container less than 30 ml, with a maximum net quantity of 500 ml for the entire package) of ETOH can be shipped with "Excepted Quantities" labels without completion of a Dangerous Goods Declaration. (e.g., If shipping vials having a maximum volume of 10 ml each, you may put up to 50 vials in one box.) **I understand (_____)**

b) **Package Components**:

i. ***Inner (primary) packaging (e.g., vial, tube, jar, etc.)***: Do not completely fill inner packaging; allow 10% head-space for liquid expansion. Liquids must not completely fill inner packaging at a temperature of 55°C (130°F). Closures of inner packaging (e.g., vials with tops) must be held securely in place with tape or other positive means. **I understand (_____)**

ii. ***Intermediate (secondary) packaging (e.g. Ziplock or other plastic bag)***: Place inner container(s) (*e.g.,* vials with ETOH) into a high-quality plastic bag. Then add an absorbent material capable of absorbing any spillage without reacting with the ethanol. Seal the first bag tightly and then tape the locking seals. Next, seal the inner bag within a second bag for added safety. **I understand (_____)**

iii. ***Outer packaging (e.g., cardboard box)***: Ethanol solutions may not be shipped in envelopes, Tyvek® sleaves, or other non-rigid mailers. The dimensions of the outer box must be at least 100 mm (~4 inches) on two sides. Any space between the inner packing containers placed in the outer packaging should be eliminated with additional filler. **I understand (_____)**

c) **Package Labels**:

i. ***Dangerous Goods in Excepted Quantities Label*** **(Figure 1.)**: The label must display a "3" as the ethanol hazard class number using a black marker. You may obtain self-adhesive labels from NMFS, or else, order online. **I understand (_____)**

ii. ***Name and Address:*** The outer container must display the name and address of the shipper and consignee. When re-using shipping boxes, completely remove or black out all unnecessary labels or marks. **I understand (_____)**

Figure 1. Dangerous Goods in Excepted Ouantities label

Appendix 3c (continued)

d) **Package Tests:**

A representative example of packaging used for excepted quantities of ethanol solutions must pass a drop test and compressive load test without any breakage or leakage of any inner packaging and without any significant reduction in package effectiveness. Perform the following tests on a representative example of your packaging and keep a record of the results.

i. ***Drop Test***: Drop a representative package from a height of 1.8 m (5.9 feet) directly onto a solid unyielding surface:

		Test Results
a.	One drop flat on the base;	(_____)
b.	One drop flat on top;	(_____)
c.	One drop flat on the longest side;	(_____)
d.	One drop flat on the shortest side; and	(_____)
e.	One drop on a corner.	(_____)

ii. ***Compressive Load Test***: Apply a force to the top surface of a representative package for a duration of 24 hours, equivalent to the total weight of identical packages if stacked to a height of 3 meters. (_____)

e) **Package Documentation:**

Proper documentation is required for all shipments of hazardous materials. Incorrect documentation is the most common cause for package refusal. If using documentation for couriers other than FedEx, UPS and DHL, please contact NMFS for assistance.

i. ***FedEx***: For domestic shipments with FedEx Express, fill out the standard US Airbill. Fill out the form completely including the following information:

a. In Section 6, Special Handling, check the box "Yes, Shipper's Declaration not required."
b. On the top of the form above the FedEx tracking number, include the statement, "***Dangerous Goods in Excepted Quantities***" See example in **Figure 2.** **I understand (_____)**

ii. ***DHL:*** The "*Nature and Quantity of Goods*" box of the air waybill must include "**Dangerous Goods in Excepted Quantities.**" **I understand (_____)**

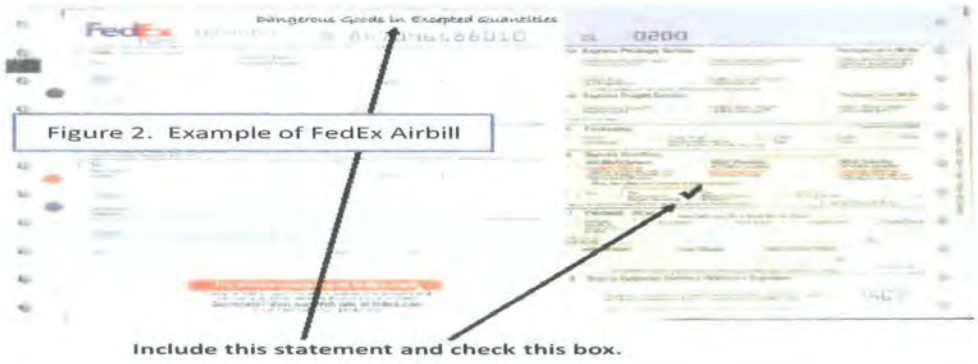


Figure 2. Example of FedEx Airbill

By signing this document, I affirm I understand the hazards associated with ethanol and the shipping requirements for ethanol solutions, as outlined in this guide. I also understand I am required to include a copy of this document in the package and that it should be appended to an ESA permit (if listed samples are shipped).

Print Name:		Signature:	
Employer:		Employer Address:	
Date:			Phone: